ANALYSIS OF CLINICAL, RADIOLOGICAL AND FUNCTIONAL OUTCOME OF PROXIMAL FEMORAL NAILING IN UNSTABLE INTERTROCHANTERIC FRACTURES

Dissertation submitted for

M.S. DEGREE (BRANCH – II – ORTHOPAEDIC SURGERY)

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI, TAMILNADU

APRIL – 2014

CERTIFICATE

This is to certify that this dissertation titled **"ANALYSIS OF CLINICAL, RADIOLOGICAL AND FUNCTIONAL OUTCOME OF PROXIMAL FEMORAL NAILING IN UNSTABLE INTERTROCHANTERIC FRACTURES"** is a bonafide record of work done by **Dr.P.SIVAKUMAR,** during the period of his Post graduate study from May 2011 to November 2013 under guidance and supervision in the Institute of Orthopaedics and Traumatology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai-600003, in partial fulfillment of the requirement for **M.S.ORTHOPAEDIC SURGERY** degree Examination of The Tamilnadu Dr. M.G.R. Medical University to be held in April 2014.

PROF. V.SINGARAVADIVELU,
M.S.Ortho., D.Ortho
PROFESSOR & CHIEF,
INSTITUTE OF ORTHOPAEDICS
AND TRAUMATOLOGY
MADRAS MEDICAL COLLEGE &
RAJIV GANDHI GOVT GEN.
HOSPITAL
CHENNAI – 3.

PROF.V.KANAGASABAI, M.D.,
DEAN
MADRAS MEDICAL COLLEGE&
RAJIV GANDHI GOVT GEN.
HOSPITAL CHENNAI-3.

CERTIFICATE

This is to certify that this dissertation in **"ANALYSIS OF CLINICAL, RADIOLOGICAL AND FUNCTIONAL OUTCOME OF PROXIMAL FEMORAL NAILING IN UNSTABLE INTERTROCHANTERIC FRACTURES"** is a bonafide work done by **Dr. SIVAKUMAR. P** under my guidance during the period 2011–2014. This has been submitted in partial fulfilment of the award of M.S. Degree in Orthopedic Surgery (Branch–II) by The Tamilnadu Dr.M.G.R. Medical University, Chennai.

PROF.M.R.RAJASEKAR, M.S.Ortho., D.Ortho
DIRECTOR,
INSTITUTE OF ORTHOPAEDICS &
TRAUMATOLOGY
MADRAS MEDICAL COLLEGE &
RAJIV GANDHI GOVT GEN. HOSPITAL
CHENNAI- 600003.

DECLARATION

I declare that the dissertation entitled **"ANALYSIS OF CLINICAL, RADIOLOGICAL AND FUNCTIONAL OUTCOME OF PROXIMAL FEMORAL NAILING IN UNSTABLE INTERTROCHANTERIC FRACTURES"** submitted by me for the degree of M.S is the record work carried out by me during the period of March 2012 to August 2013 under the guidance of **Prof.V.SINGARAVADIVELU,** M.S.ortho., D.Ortho., Professor of Orthopaedics, Institute of Orthopaedics and Traumatology, Madras Medical College, Chennai. This dissertation is submitted to the Tamilnadu Dr.M.G.R. Medical University, Chennai, in partial fulfillment of the University regulations for the award of degree of M.S.ORTHOPAEDICS (BRANCH-II) examination to be held in April 2014.

Place: Chennai Signature of the Candidate

Date: **(Dr. P.SIVAKUMAR)**

ACKNOWLEDGEMENT

I express my thanks and gratitude to our respected Dean **Dr.KANAGASABAI, M.D.,** Madras Medical College, Chennai – 3 for having given me permission for conducting this study and utilize the clinical materials of the hospital.

I have great pleasure in thanking **Prof.M.R.RAJASEKAR M.S,Ortho., D.Ortho**. Director, Institute of Orthopaedics and Traumatology, for his guidance and constant advice throughout this study.

My sincere thanks and gratitude to **Prof.V.SINGARAVADIVELU. M.S.Ortho., D.Ortho**. Professor, Institute of Orthopaedics and Traumatology, for his guidance and valuable advice provided throughout this study.

My sincere thanks and gratitude to, **Prof.N.DEEN MUHAMMED ISMAIL, M.S.Ortho., D.Ortho.,** Professor, Institute Of Orthopaedics and Traumatology, for his constant inspiration and advise throughout the study.

My sincere thanks and guidance to **Prof.A.PANDIASELVAN. M.S.Ortho., D.Ortho**. Associate Professor, Institute Of Orthopaedics and Traumatology, for his valuable advice and support.

I sincerely thank **Prof.NALLI R.UVARAJ M.S.Ortho**., **D.Ortho.,** for his advice, guidance and unrelenting support during the study and I also thank **Prof. Sudhir** for his support.

I sincerely thank **Dr.Prabhakaran, Dr.Pazhani, Dr.Hemanthakumar, Dr.Shanmugasundaram, Dr.Manimaran, Dr.Karunakaran, Dr.Kannan, Dr.velmurugan, Dr.Senthilsailesh, Dr.Kingsly, Dr.Kaliraj, Dr.Nalli R.Gopinath, Dr.Muthalagan**, Assistant Professors of this department for their valuable suggestions and help during this study.

I also thank all anaesthesiologists and staff members of the theatre and wards for their support during this study.

I am grateful to all my post graduate colleagues for their support in this study. Last but not the least, my sincere thanks to all our patients, without whom this study would not have been possible.

CONTENTS

S.NO	TITLE	PAGE NO
1.	INTRODUCTION	1
2.	AIM OF THE STUDY	3
3.	REVIEW OF LITERATURE	4
4.	APPLIED ANATOMY	15
5.	MECHANISM OF INJURY	21
6.	MATERIALS AND METHOS	23
7.	OBSERVATION AND RESULTS	47
8.	CASE ILLUSTRATION	60
9.	DISCUSSION	70
10.	CONCLUSION	75
11.	BIBLIOGRAPHY	
12	ANNEXURE	
	PROFORMA	
	INFORMATION CHART	
	PATIENT CONSENT FORM	
	ETHICAL COMMITTEE FORM	
	PLAGIARISM	
	DIGITAL RECEIPT	
	MASTER CHART	

INTRODUCTION Intertrochanteric fracture is one of the most frequently operated injuries in the elderly. The incidence of these fractures increases with increasing in age. These patients are limited to home ambulation. Since most of them are elderly people quality of life will be poor if it is not stabilized and patients are mobilized early. Intramedullary position of the Proximal femoral nail prevents the excessive collapse of proximal fragment & medialisation of distal fragment. Being a intramedullary load sharing device, Proximal femoral nail helps in early post operative mobilization, weight bearing and ultimately the early fracture union. Being done as a closed nailing procedure most of the time Proximal femoral nail preserves the fracture haematoma and associated with less blood loss and short operating time.

AIM: To assess the clinical radiological and functional outcome of proximal femoral nailing in unstable intertrochanteric fractures

MATERIALS & METHODS

At our institution we have performed surgery for 22 cases of unstable inter trochanteric fractures with proximal femoral nailing. Out of which 20 cases came for regular follow up and they were included in the study.

Cases were selected according to inclusion and exclusion criteria.

Inclusion criteria

Unstable intertrochanteric fracture Boyd and griffin type 2 , 3 and 4 and Age > 18 years

Exclusion criteria

1) Compound injury 2. stable two part fracture **3.**Patients with severe comorbid conditions **4.**Age < 18 years **5.**Predominantly subtrochanteric fracture with intertrochanteric extension.

Surgery was done in standard radiolucent fracture table with patient in supine position with adduction of affected limb by 10-15^{o}. Closed reduction of fracture was done with gentle traction and rotation. The unaffected limb was placed in flexion and abduction so that it does not interfere with image intensifier. The C-arm was placed in a position to take anteroposterior and lateral views of hip. The patient was then painted and draped. In patients where reduction was not achieved by manipulation , a small 0.5 cm incision was made and fracture was reduced with the help of bone hook or curved artery forceps.The mobilization of hip fracture patients out of bed begin and ambulation training was initiated on postoperative day one. Furthermore, any patient who has been surgically treated for an intertrochanteric fracture was allowed to bear weight as tolerated.Functional outcome was studied with Harris hip score.

OBSERVATION AND RESULT

Operative time varied from 43 minutes to 90 minutes with average of 67.6 minutes Blood loss varied from 130 ml to 325 ml with mean loss of 187ml. The age group varied from a minimum of 33 years to a maximum of 80 years and average age was 54.8 years. Duration of the study was from March 2012 to August 2013.Maximum follow up is 18 months and minimum followup is 3 months. Mean follow up was 10 months. of the 20 patients 15 were male and five were female. Right side was involved in 12 cases and Left side in 8 patients. 16 patients were manual laborers, four were sedentary workers.The average interval from the injury to the time of surgery was 10.2 days.All the patients were managed initially with skeletal traction before taking up for surgery.

Average union time in weeks is 14.6 weeks.(Range 12 to 18 weeks). In our series union was delayed in all type IV cases(17- 18 weeks).

Harris hip Score at the end of 3 month is 73.8 and at end of 6 months is 84.3. Sixteen patients who were manual laborers went back to their original work.At the end of 6 months the result was Excellent in 5 cases .Good in 11 cases, fair in 3 cases and poor in 1 case. None of the patients developed thigh pain.

CONCLUSION :Proximal femoral nail is an excellent device for unstable intertrochanteric fractures and it is technically demanding procedure. Proper reduction, correct entry point of nail , placement of neck screws of adequate length determines the outcome of surgery.The results are better if surgery is done earlier.Early mobilization and weight bearing is allowed in patients treated with Proximal femoral nail thereby decreasing the incidence of bedsores, uraemia and hypostatic pneumonia.Proximal femoral nail is a significant advancement in the treatment of unstable trochanteric fractures which has the unique advantage of closed reduction, preservation of fracture hematoma, less tissue damage during surgery, early rehabilitation and early return to work.When properly done Proximal femoral nail can give better results than other devices for unstable intertrochanteric fractures.

INTRODUCTION

INTRODUCTION

Intertrochanteric fracture is one of the most frequently operated injuries in the elderly[1]. The incidence of these fractures increases with increasing in age[2]. These patients are limited to home ambulation. With increasing life expectancy we see a lot of intertrochanteric fractures today. Gulberg et al[3] estimated that the incidence of hip fractures worldwide will double by 2025 and quadruple by 2050. Since most of them are elderly people quality of life will be poor if it is not stabilized and patients are mobilized early.

The sliding hip screw device was used for more than a decade for the treatment of these type of fractures. Although Zickel introduced his nail long ago, it was not a very popular fixation device due to its higher rate of complications. Same was the case with Enders nail. The Zickel nail was later modified and renewed interest is being given to intramedullary fixation with devices like the Proximal Femoral Nail, Intramedullary Hip Screw and Gamma Nail due to shorter operating time, less blood loss and earlier mobilization[17]. Side plate devices when used for unstable intertrochanteric fractures which are commonly associated with lateral wall comminution results in excessive collapse of the proximal fragment and gross

medialisation of distal fragment resulting in implant failure and delayed union or non union at fracture site. Intramedullary position of the Proximal femoral nail prevents the excessive collapse of proximal fragment & medialisation of distal fragment.

Being a intramedullary load sharing device, Proximal femoral nail helps in early post operative mobilization, weight bearing and ultimately the early fracture union[2].

Being done as a closed nailing procedure most of the time Proximal femoral nail preserves the fracture haematoma and associated with less blood loss and short operating time.

AIM OF THE STUDY

AIM OF THE STUDY

To assess the clinical, radiological and functional outcome of unstable intertrochanteric fractures treated with Proximal femoral nailing in our Institute of Orthopaedics and Traumatology, Madras medical College and Rajiv Gandhi Government General Hospital between the period of March 2012 and August 2013.

REVIEW

OF

LITERATURE

HISTORY AND REVIEW OF LITERATURE

In 1822, Ashley Cooper[4] recognized fractures in the proximal femur and distinguished between fractures in the neck of femur (intracapsular) and those outside the capsule (extracapsular) in the intertrochanteric region. He noted that fractures inside capsule did not unite and those outside unite well without difficulty often with external rotation and shortening leading to coxa vara.

In 1878 **Langeneck and Koenigs** first performed open reduction and internal fixation using a nail for fixation of the hip fractures.

In 1881 **Senn** was the first to publish an account on the use of a screw for internal fixation.

In1900 **David** used ordinary wood screw.

In 1902, **Royal Whitman** first reported on the reduction of intertrochanteric fractures with abduction, internal rotation, and traction

under anaesthesia with immobilization in hip spica from the nipple line to toes

In 1911,**Cotton**[5] was the first to recommend impaction of fragments by hammering over trochanter but this method failed until **Putti** (1940) and **Lippman** (1937) independently devised corkscrews to make fragments Penetrate each other.

Till the 1940s the standard treatment was reduction of the fracture and immobilization in plaster spica or in traction.

The justification for early rehabilitation in this group was accurately summed up by this quotation by **Evans in 1949** ……"The very old patients who sustain this injury tolerate pain and immobility badly; their mental state is often precarious and is quick to develop bed sores or pulmonary complications. We believe that they should be treated as surgical emergency and the older and more eebler the patient the more urgent is the need for the operation"

In 1925 **Smith Petersen** reported an account on use of triflanged nailing.

In the year of 1932 **Johannsenn** introduced a cannulated triflanged nail.

In 1937 **Thornton** devised plate attachment for the triflanged nail.

In 1941 **Jewett**[6] pioneered a one-piece implant by adding a solid plate to the triflanged cannulated nail.

In the year of **1944 Austin and Moore** introduced a blade and plate, also advocated the use of Multiple pins which prevented rotations and supported the proximal fragment in all quadrants.

In 1947 Mc Laughlin designed a variable angled nail plate which was string and did not require bending of the plate to change the angle while attaching to the smith peterson nail.

In the year of 1955 Schumpelick and Jantzan described a sliding screw, the design of which they attributed to Ernest Pohl.

In 1964 Clawson reported the use of a sliding screw and plate. The device was manufactured independently by Richard.s manufacturing co.

In 1967 [7] **Zickel** described a Y shaped device which combined an intramedullary nail with a triflanged nail and was passed into the neck and head.

In 1974 Tronzo reported using a Matchett – Brown endoprosthesis in the primary treatment of unstable intertrochanteric fractures.

In **1978 Ender** described a closed method of passing flexing nails retrograde in to the neck.

In **1980 Harris** described closed condylocephalic nailing **.**

Since 1985, Gamma nail was used to treat unstable intertrochanteric fractures.[9]

The gamma nail transmits weight closer to calcar than does the dynamic hip screw and it has great mechanical strength. Initial design had excess of medial curvature of implant which led to fracture of greater trochanter, and late coxa vara deformity due to disengagement of shoulder hip screw[9]. Then later these defects were modified by reducing medial curvature and extending shoulder of hip screw proximally and reducing length of nail from 220 mm to 200 mm.

This third version of the nail was in use since may 1988.

The third version of gamma nail has proximal diameter of 15.5 mm and length of 180 mm. Lag screw diameter is 11 mm. This nail has advantage of semiclosed intramedullary nailing, dynamic neck screw and earlier mobilization of patient postoperatively.[10]

However several complications like fracture of femoral shaft occurred with gamma nail in 17% of patients[10], failure of fixation in 7% and complications of distal locking in 10% of cases. In order to counteract these complications modifications are made and proximal femoral nail was introduced.

In 1996, AO developed the proximal femoral nail with antirotational hip pin together with a smaller distal shaft diameter of nail which reduced stress concentration to avoid failures**.**

According to **RANJEETESHKUMAR**[2], Cephalomedullary nailing devices like the Proximal femoral nail, the Intramedullary hip screw and the Gamma nail couple a sliding hip screw with a locked intramedullary nail. These devices offer Several Advantages, a) an intramedullary nail because of its location theoretically provides more efficient load transfer compared to a sliding hip screw. b) the short lever arm of the intramedullary device can be expected to decrease the tensile strain on the implant, thereby decreasing the risk of implant failure, c) because intramedullary fixation device incorporates a sliding hip screw, the advantage of controlled fracture impaction is maintained.

Intramedullary nailing is a more technically demanding procedure. The Proximal femoral nail is an effective intramedullary load-sharing device. It incorporates the principles and theoretical advantages of the Zickel nail, Dynamic hip screw and locked intramedullary nail. Biomechanically the Proximal femoral nail is more stiff; it has a shorter moment arm (i.e., from the tip of the lag screw to the center of the femoral canal) whereas the DHS has a longer moment arm (i.e., from the tip of the lag screw to the lateral cortex). The DHS with a longer moment arm undergoes significant stress on weight bearing and hence higher incidence of lag screw cut out and varus malunion. The larger proximal diameter of the Proximal femoral nail additional stiffness to the nail Minimal blood loss, shorter operative time and early weight bearing are all the advantages of the Proximal femoral nail whereas the DHS has a longer operating time, more blood loss.

According to **MINOS TYLLIANAKIS**[12] who had treated patients with proximal femoral nail,the proximal femoral nail has many biomechanical advantages than Gamma nail which was used previously

1) The addition of 6.5 mm anti-rotation hip pin to reduce the incidence of implant cut-out and rotation of the cervico-cephalic fragment,

2) The smaller diameter and fluting of the tip of the nail, specially designed to reduce stress forces below the implant and therefore the incidence of low-energy fracture at the tip,

3) The greater implant length, smaller valgus angle and setting of this angle at a higher level (11 cm from the proximal end), and

4) The more proximal positioning of the distal locking, to avoid abrupt changes in stiffness of the construct. In this respect, it should be borne in mind that the neck screw must be adjusted to the calcar, taking into account the need to place the antirotational hip pin

'Z' EFFECT AND REVERSE Z EFFECT

Werner Et al[8] were the first to introduce the term Z effect.'Z' effect and reverse Z effect is a peculiar complication of Proximal femoral nail. Nail is fixed with 2 screws; the larger (lag) screw is designed to carry most of the load, and smaller screw (the hip pin) is to provide rotational stability. If the hip pin is longer than the lag screw, vertical forces would increase on the hip pin and start to induce cut-out, a knife effect or Z-effect. This might

force the hip pin to migrate into the joint and the lag screw to slide laterally. The cut-out rate with a Proximal femoral nail is reportedly 0.6 to 8%. Although complication rates remain low, cut-out of either screw is a serious complication, which can lead to revision surgery and related morbidity. When the hip pin was 10mm shorter than the lag screw, the percentage of the total load carried by the hip pin ranged from 8 to 39% (mean, 21%), no cut-out of the femoral head and no unacceptable implant or fracture displacement were observed.

Fig – 1 : Showing Z Effect

Reverse Z effect (Boldin et al) involves the lateral migration of the superior screw with medial migration of inferior screw.cause of this complications are due to varus collapse, lack of medial support, improper entry point of nail.

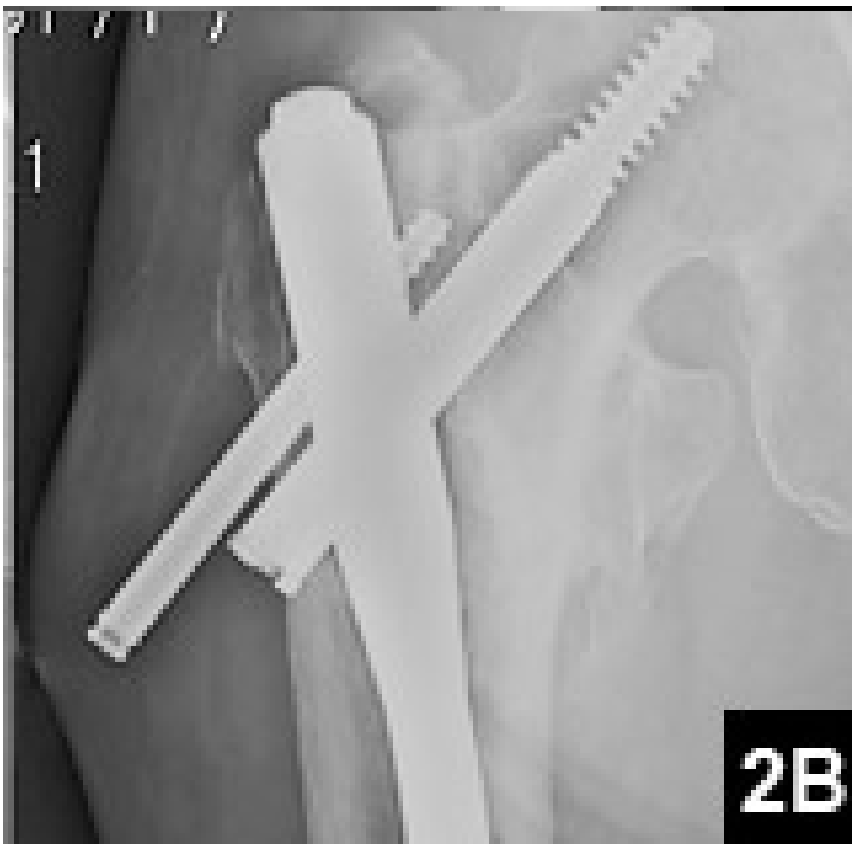


Fig – 2: Showing Reverse Z Effect

POST OPERATIVE FEMORAL SHAFT FRACTURE

According to **HalderS.C**[9] Older generation cephalomedullary Nails had very large distal locking screw near the tip of the Nail with associated risk of stress riser near the Nail Tip causing post operative femoral shaft fracture near the Nail tip.

In Proximal femoral nail stress riser effect is decreased by the tapered distal end of the Nail and the distal locking screws are placed more proximally on the Nail.

APPLIED ANATOMY

APPLIED ANATOMY

The intertrochanteric region of the hip consisting of the area between the greater and lesser trochanters represents a zone of transition from femoral neck to the femoral shaft. This area is characterized primarily by dense trabecular bone that serves to transmit and distribute stress similar to the cancellous bone of the femoral neck. The greater and lesser trochanters are the sites of insertion of the major muscles of the gluteal region, the gluteus medius and minimus, the iliopsoas and short external rotators.

The Calcar femorale, a vertical wall of dense bone extending from the posteromedial aspect of the femoral shaft to the posterior portion of the femoral neck forms an internal trabecular strut within the inferior portion of the femoral neck and intertrochanteric region which acts as a strong conduit for stress transfer.

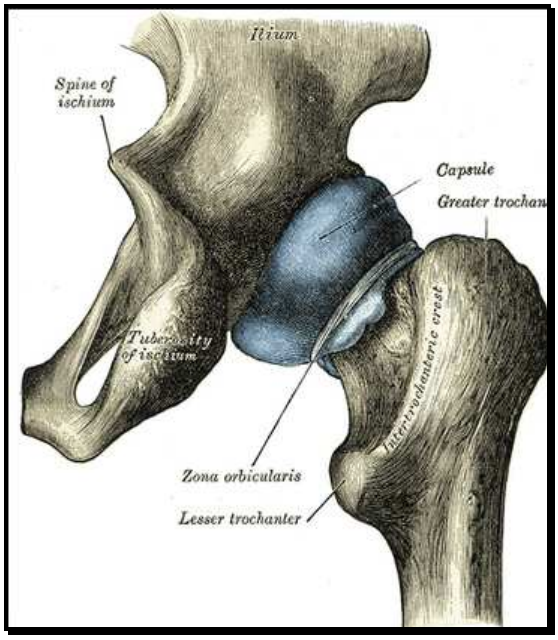


Fig – 3 : Bony Landmarks In Hip Regim

The musculature of the hip region can be grouped according to function and location.

ABDUCTORS

The gluteus medius and gluteus minimus , which originate from the outer table of the ilium and insert onto the greater trochanter, function to control pelvic tilt in the frontal plane.

INTERNAL ROTATORS OF HIP

The gluteus medius and gluteus minimus, along with the tensor fascia lata.

HIP FLEXORS

Flexors are located in the anterior aspect of the thigh and include the sartorius, pectineus, iliopsoas, and rectus femoris. The iliopsoas inserts onto the lesser trochanter.

ADDUCTORS

The gracilis and the adductor muscles (longus, brevis, and magnus) are located in the medial aspect of the thigh.

EXERNAL ROTATORS

The short external rotators, the piriformis, obturator internus, obturator externus, superior and inferior gemelli, and quadratus femoris, all insert onto the posterior aspect of the greater trochanter.

HIP EXTENSORS

The semitendinosus, semimembranosus, and biceps femoris, which originate from the ischium to form the hamstring muscles of the thighalong with gluteus maximus are responsible for knee flexion as well as hip extension.

The gluteus maximus, originating from the ilium, sacrum, and coccyx, inserts onto the gluteal tuberosity along the linea aspera in the subtrochanteric region of the femur and the iliotibial tract. The gluteus maximus serves as an extensor and external rotator of the hip.

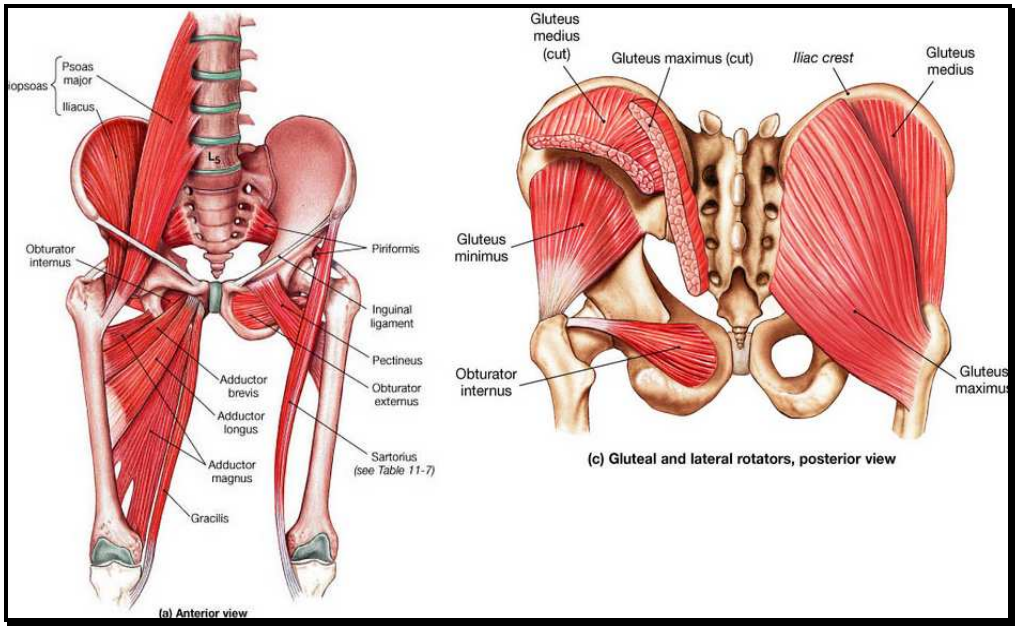


Fig - 4: Anterior And Posterior View Of Hip Region Showing Muscles Around Hip

BLOOD SUPPLY

TROCHANTERIC ANASTOMOSIS

The trochanteric anastomosis lies near the trochanteric fossa of the femur. It is an anastomosis between the ascending branch of the medial circumflex femoral artery and descending branches of the superior and inferior gluteal arteries. The lateral circumflex femoral artery and the first perforating artery from the profunda may also contribute, creating an extracapsular 'arterial ring of the femoral neck . Branches from this ring, the retinacular vessels, pierce the capsule and ascend along the femoral neck to give the main blood supply to the head of the femur.

CRUCIATE ANASTOMOSIS

The cruciate anastomosis lies at the level of the lesser trochanter, near the lower edgeof the femoral attachment of quadratus femoris. It is an anastomosis between the transverse branches of the medial and lateral circumflex femoral arteries, a descending branch of the inferior gluteal artery and an ascending branch from the first perforating artery.

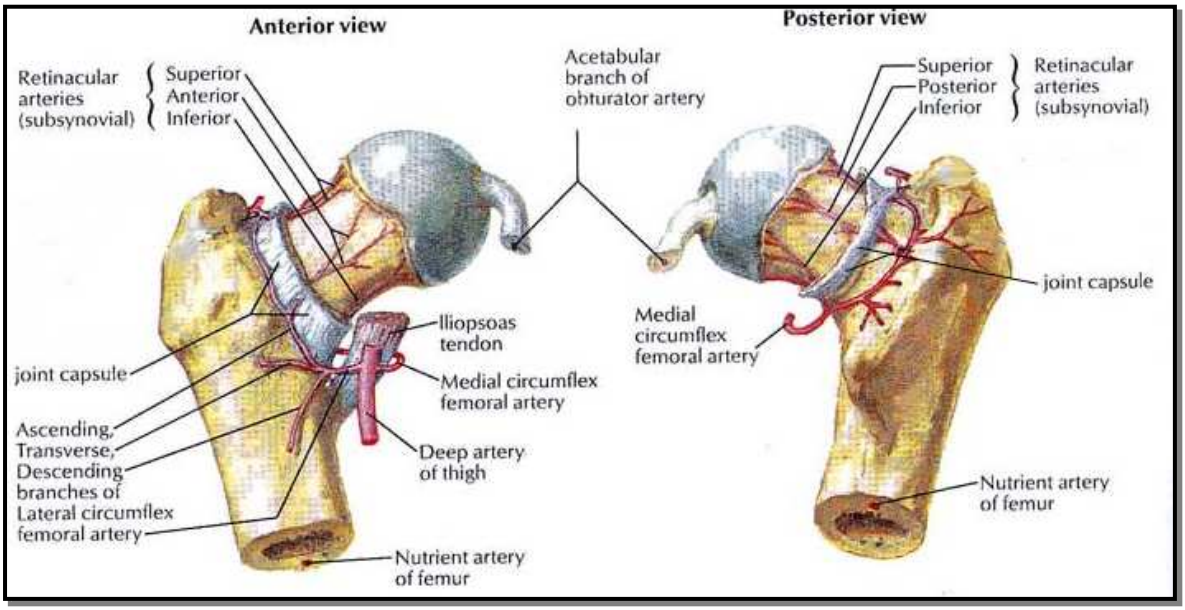


Fig – 5 : Showing Blood Supply Around Hip Region

MECHANISM

OF

INJURY

MECHANISM OF INJURY

Intertrochanteric fractures in young adults are the results of high energy trauma like road traffic accidents or fall from height. In contrast, most of fractures occurring in the elderly are due to a simple fall. The tendency to fall increases with age and is exacerbated by several factors like poor vision, altered blood pressure, poor body reflexes, decreased muscle power, vascular disease and co existing musculoskeletal pathology.

Cummings and Nevitt[18] identified four factors that determine whether a particular fall results in a fracture in the hip.

1) The fall must be oriented that the person lands on or near the trochanter

2) Inadequate protective reflexes that do not reduce the energy of fall

3) Deficient local shock absorbers (muscle and bone around the hip)

4) Insufficient bone strength at the hip – Osteoporosis to withstand the energy impacted

SIGNS AND SYMPTOMS

Fractures may be undisplaced or impacted and, such patients may present with minimal pain at the hip or may present with thigh pain. They

may be ambulant. Whereas patients with displaced fractures are clearly symptomatic usually cannot stand and are nonambulant.

Patients with undisplaced fracture may present with virtual absence of clinical deformity whereas those with displaced fracture exhibit the classical presentation of shortened and externally rotated extremity. There may be tenderness on palpation in the area of the greater trochanter. Ecchymoses may be present and should be noted.

FORCES ACTING ON THE HIP

The body weight can be depicted as a load applied to a lever arm extending from the body's center of gravity to the center of the femoral head.

The abductor musculature, acting on a lever arm extending from the lateral aspect of the greater trochanter to the center of the femoral head, must exert an equal moment to hold the pelvis level when in a one- legged stance, and a greater moment to tilt the pelvis to the same side when walking or running. The ratio of the length of the lever arm of the body weight to that of the abductor musculature is about 2.5:1.

MATERIALS

AND

METHODS

MATERIALS & METHODS

At our institution we have performed surgery for 22 cases of unstable inter trochanteric fractures with proximal femoral nailing. Out of which 20 cases came for regular follow up and they were included in the study.

Cases were selected according to inclusion and exclusion criteria.

INCLUSION CRITERIA

Unstable intertrochanteric fracture Boyd and griffin type 2 , 3 and 4

1) Posteromedial large separate fragmentation
2) Reverse obliquity pattern
3) Displaced greater trochanter (lateral wall fracture)
4) Comminuted intertrochanteric fracture
5) Predominantly intertrochanteric fracture with subtrochanteric extension
6) Age > 18 years

EXCLUSION CRITERIA

1) Compound injury
2) Stable two part fracture
3) Patients with severe comorbid conditions
4) Age < 18 years
5) Predominantly subtrochanteric fracture with intertrochanteric extension.

PATIENT EVALUATION

Patients were admitted both in Emergency department and as regular Outpatient Department of those suspected hip injury. Elucidating history to assess the force & nature of violence, mode of injury, co morbid illness, history of previous surgeries, head injury or other system involvement. Thorough general examination & evaluation of the patient as a whole and the limb in specific the survey is done.

In case of polytrauma due to RTA complete skeletal survey including the clavicle, chest, whole spine, pelvis and all long bones was done. Systemic examination of cardiac, respiratory, abdominal and neurological functions was done. The lower limb is surveyed for the injuries, to assess the

skin condition, neurovascular status, clinical signs of fracture & its displacement with deformity. Distal pulses are checked & compared with other side. Peripheral Nerve examination is carried out. Those patients who belong to our inclusion criteria were subjected to further radiological evaluation.

RADIOGRAPHIC AND OTHER IMAGING STUDIES

Standard radiographic examination includes Anteroposterior view of the Pelvis and an Anteroposterior and cross table lateral view of the proximal femur. The lateral radiograph is used to assess the posterior comminution of the proximal femur. An internal rotation view of the injured hip is useful to identify undisplaced fractures..A second AP view of the contralateral side may be useful for preoperative planning.

Fig – 6 : Antero Posterior View of Pelvis with both hips

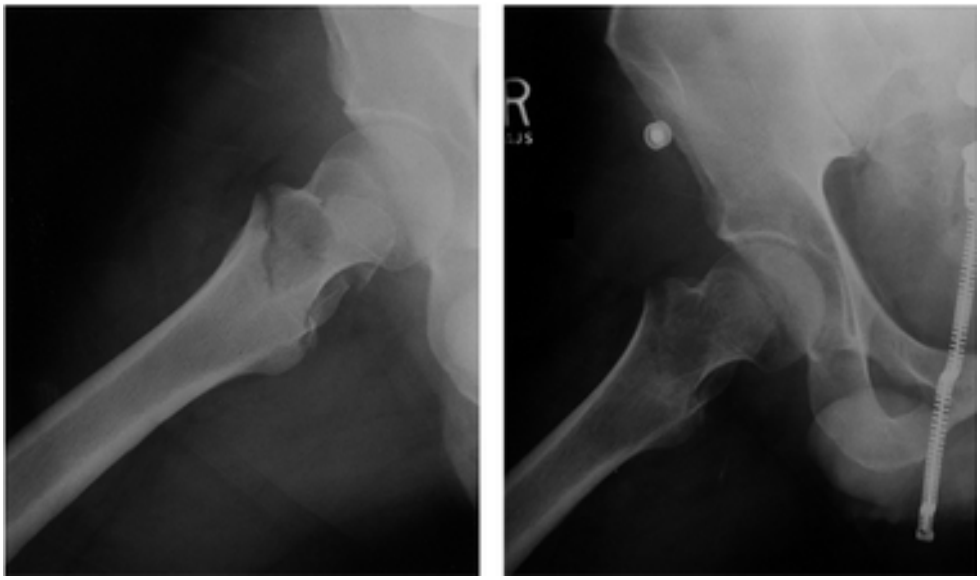


Fig – 7 : Cross Table Lateral View

CLASSIFICATION

The commonly used classification is the Boyd and Griffin classification.

BOYD AND GRIFFIN CLASSIFICATION (1949):

His classification included all fractures from the extracapsular part of neck to a point 5 cm distal to the lesser trochanter.

Type 1: Fractures that extend along the intertrochanteric line from the greater to the lesser trochanter and it is stable (two part). Reduction is usually simple and is maintained with little difficulty. Results are generally satisfactory.

Type 2: Comminuted unstable fractures, the main fracture being along the Intertrochanteric line but with multiple fractures in the cortex. Reduction of these fracture are more difficult because the posteromedial comminution can vary from slight to extreme.

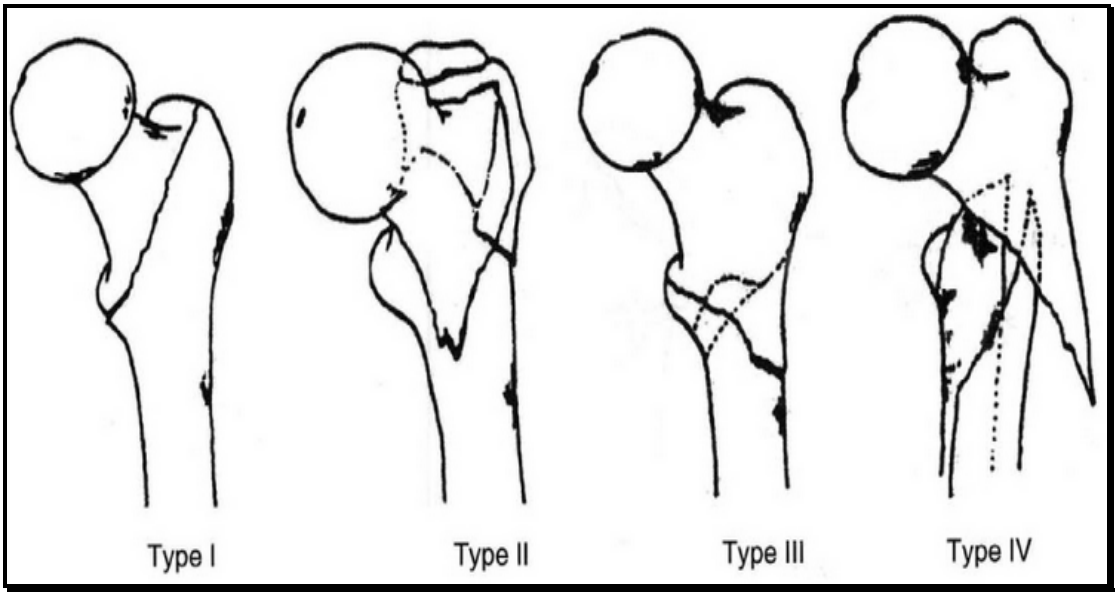


Fig – 8 : Boyd & Griffin Classification

Type 3: Fractures that are basically subtrochanteric with at least one fracture passing across the proximal end of the shaft just distal to (or) at the lesser trochanter (reverse oblique). Varying degrees of comminution are associated. These fractures are usually more difficult to reduce and result in more complications, both during operation and during convalescence.

Type 4 : Fractures of the trochanteric region and the proximal shaft, with fracture in at least two planes, one of which usually in the sagittal plane and maybe difficult to see in the routine anteroposterior roentgenograms. If open reduction and internal fixation are used two plane fixation is required because of the spiral, oblique or butterfly fracture of the shaft.

EVANS CLASSIFICATION

Evans devised a widely used classification system based on the division of fractures into stable and unstable groups. He divided the unstable fractures further into those in which stability could be restored by anatomical or near anatomical reduction and those in which anatomical reduction would not create stability. In Evans type 1 fracture, the fracture line extends upwards and outwards from the lesser trochanter. In type 2, the reverse obliquity fracture, the major fracture line extends outward and downward from the lesser trochanter. Type 2 fractures have a tendency towards medial displacement of the femoral shaft because of the pull of adductor muscles.

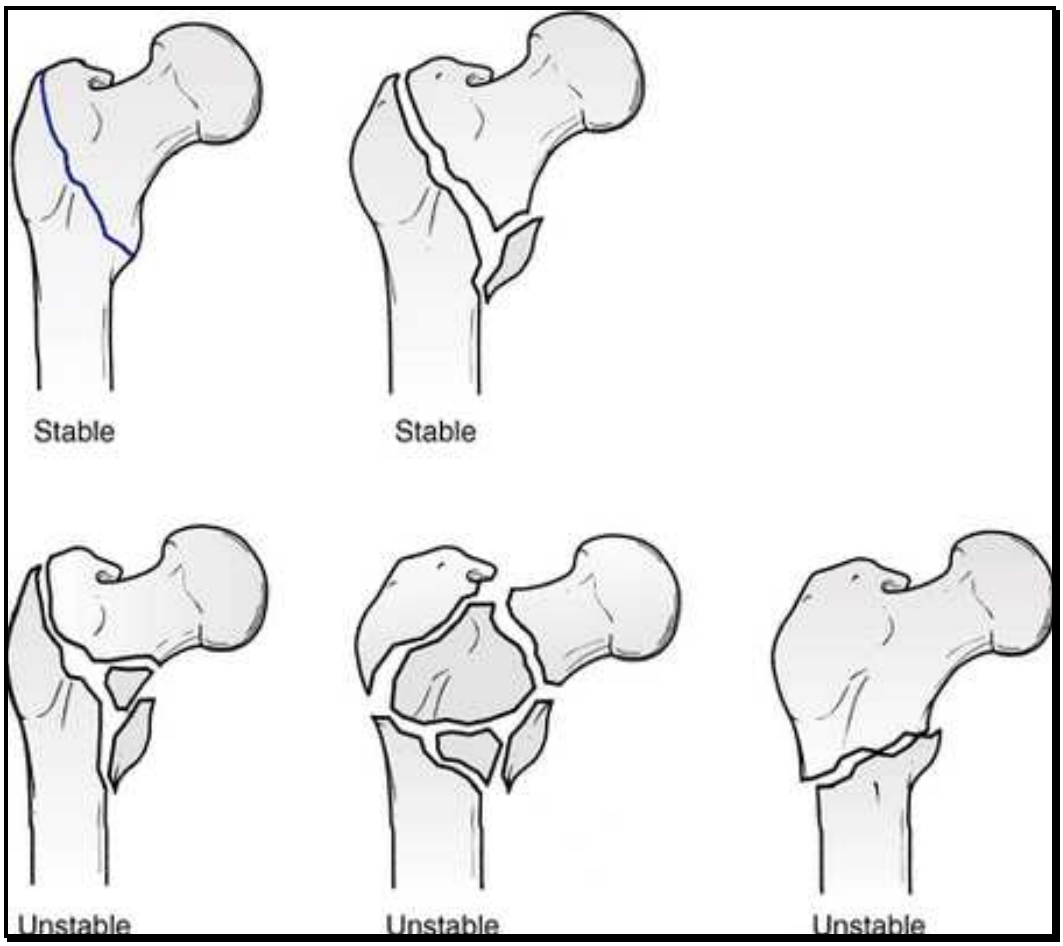


Fig – 9 : Evans Classification

JENSEN AND MICHALSEN CLASSIFICATION

STABLE

Type 1 Undisplaced – 2-part fracture.

Type 2 Displaced – 2-part fracture.

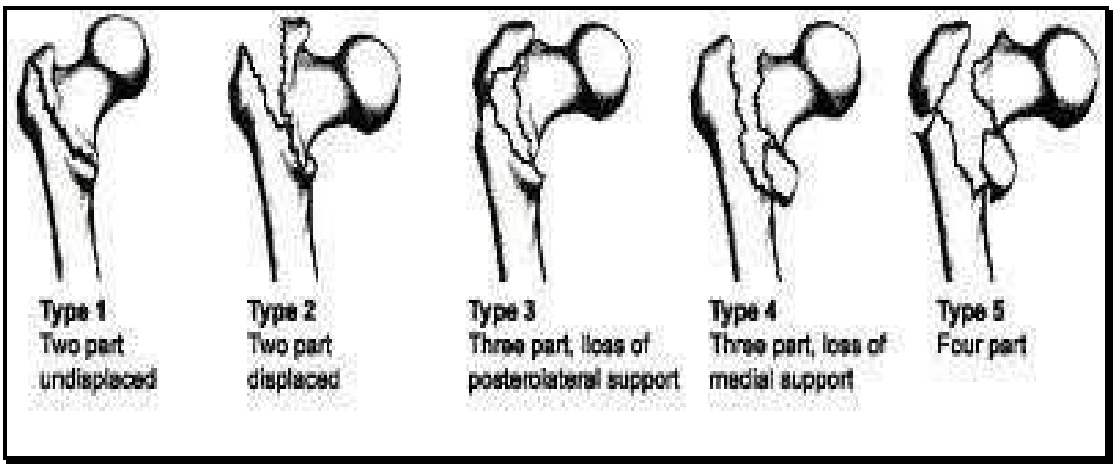


Fig – 10 : Jensen And Michalsen Classification

UNSTABLE

Type 3 Three part where greater trochanter is 3rd part, loss of medial support.

Type 4 Three part fracture where lesser trochanter is the 3rd part, loss of medial support.

Type 5 Four part fracture involves both lesser and greater trochanter loss of medial and posterolateral support.

TRONZO'S CLASSIFICATION (1973)

Fig – 11 : Tronzo's Classification

Tronzo classified the trochanteric fractures into 5 types.

Type I Incomplete trochanteric fractures-Anatomical reduction is achieved with traction.

Type II Non comminuted fractures with or without displacement in which both trochanter are fractured. They are reduced with traction. Anatomic reduction is usually achieved.

Type III Comminuted fractures in which lesser trochanter fragment is larger. The posterior wall is exploded, beak of inferior neck already displaced into medullary canal of the shaft fragment. These are so called unstable fractures. A variant of type III is also fracture and separation of greater trochanter.

Type IV Comminuted trochanteric fractures with disengagement of two main fragments. Again these are unstable with posterior wall exploded with the spike of the neck fragments displaced outside of or medial to the shaft.

Type V Trochanteric fractures with reverse obliquity. These are unstable.

ORTHOPAEDIC TRAUMA ASSOCIATION CLASSIFICATION

Group 1 fractures are simple 2 part fractures, group 2 fractures are comminuted with a posteromedial fragment the lateral cortex of the greater trochanter however remains intact. Group 3 fractures are those in which the fracture line extends across both the medial and lateral cortices. This group includes the reverse obliquity pattern.

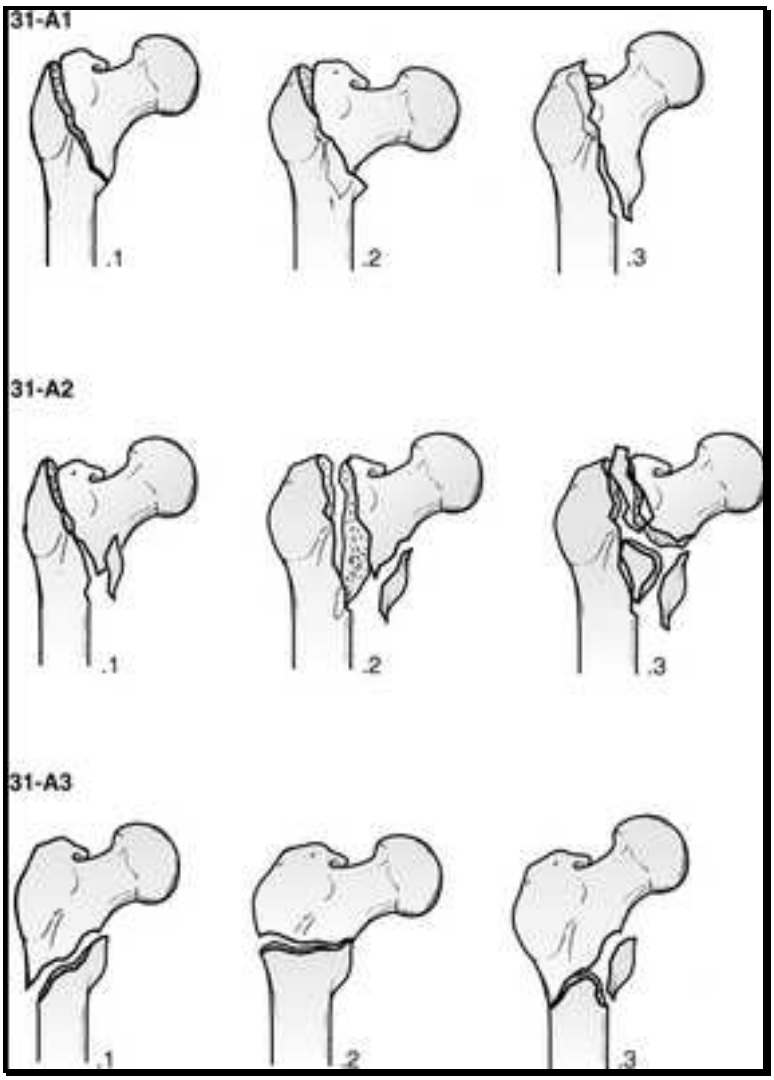


Fig – 12 : Orthopaedic Trauma Association Classification

We have followed Boyd and Griffin classification in our study because of its simplicity in usage.

PREOPERATIVE WORKUP

All the patients were put on upper tibial pin traction until surgery was done. Patients were subjected to routine blood investigations to get the anaesthetic fitness. All patients who are included in the study were explained about the surgical procedure and consent was obtained.

PRE OPERATIVE PLANNING

Pre operative templating with AP – Roentgenogram of injured hip was used to measure the nail diameter and lag screw length.

PROXIMAL FEMORAL NAIL

Evaluation of the appropriateness of an intramedullary device and estimation of nail diameter, lag screw angle, and length were performed using preoperative radiographs and templates. If there is a severe bowing of the affected femur or other associated deformity, use of an intramedullary device was avoided.

The patient was positioned supine on a fracture table, with both lower extremities resting in padded foot holders. The fracture was reduced, and the leg is placed in neutral or slight adduction to facilitate nail insertion through the greater trochanter; contra lateral leg is positioned so as to allow an unimpeded lateral radiograph. A lateral straight incision was made from tip of the greater trochanter extending proximally for 4 to 6 cm; the gluteus

medius muscle was dissected in line with its fibers. If an open reduction was required, the incision was extended distally, incising the iliotibial band in line with the skin incision. In that case, the vastus lateralis muscle was reflected anteriorly to expose the proximal femoral shaft.

The entry point for an intramedullary hip screw was at the tip of the greater trochanter,slightly medially halfway between its anterior and posterior extent. In younger individuals, particularly those with subtrochanteric fractures, it may be necessary to ream the femoral isthmus to accommodate the intramedullary nail; a ball tipped guide wire can be placed down the femoral shaft and a flexible cannulated reamer was used to enlarge the proximal shaft to the appropriate diameter. In the elderly who have larger diameter medullary canals, this step is usually not necessary. The appropriately sized intramedullary nail was then assembled with its corresponding intramedullary angle guide attachment.

It is imperative that the appropriate angle guide targets the proximal and distal holes in the nail using the drill sleeves and guide pin prior to device insertion. The nail was inserted by hand through the greater trochanter into the proximal femur. We avoided use of excessive force, which may produce comminution of the proximal femoral shaft. We used fluoroscopic evaluation to follow the progression of the nail as it was inserted.

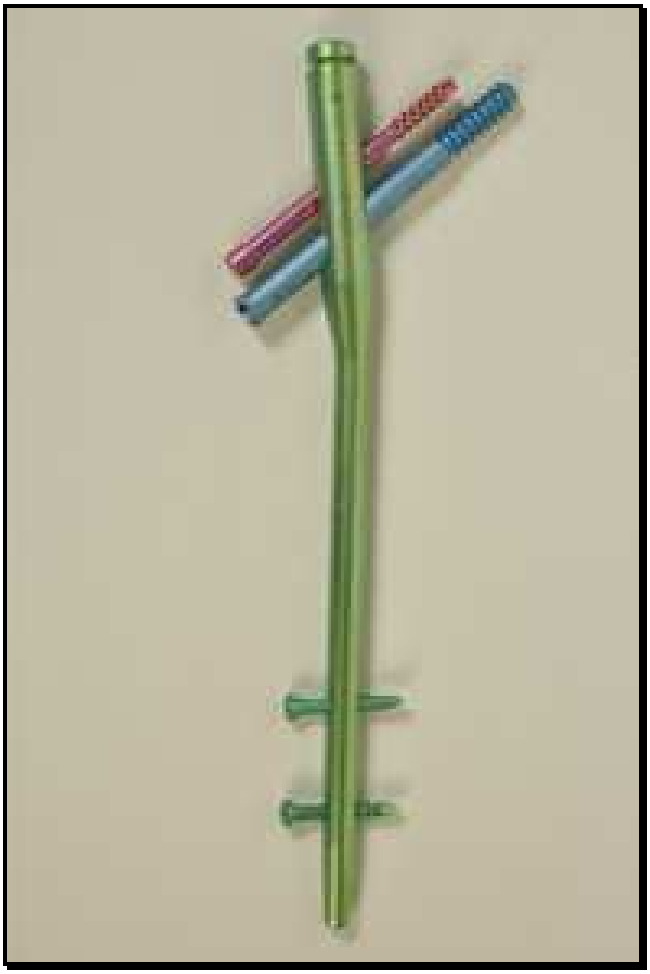


Fig – 13 : Proximal Femoral Nail with Screws

Implants & Instruments	
Length of short PFN - 135^0	25 cm
Proximal Diameter	15mm
Proximal Nail Angulation	6^o valgus
Distal diameter	9, 10, 11,12mm
Lag screw diameter	8 mm
Derotation(hip pin) screw diameter	6.5mm
Distal locking bolt	4.9mm

Jig for proximal and distal reamers & for locking

Guide wires 2 mm

Cannulated step reamer

Guide wire sleeve & drill sleeve

ANAESTHESIA, POSITIONING & FRACTURE REDUCTION

Sub Arachnoid block was used for all patients. All patients were given prophylactic antibiotics 30 minutes before surgery (1 gram of cefotaxime)

Surgery was done in standard radiolucent fracture table with patient in supine position with adduction of affected limb by 10-15^{o}. Closed reduction of fracture was done with gentle traction and rotation. The unaffected limb was placed in flexion and abduction so that it does not interfere with image intensifier. The C-arm was placed in a position to take anteroposterior and lateral views of hip. The patient was then painted and draped. In patients where reduction was not achieved by manipulation , a small 0.5 cm incision was made and fracture was reduced with the help of bone hook or curved artery forceps.

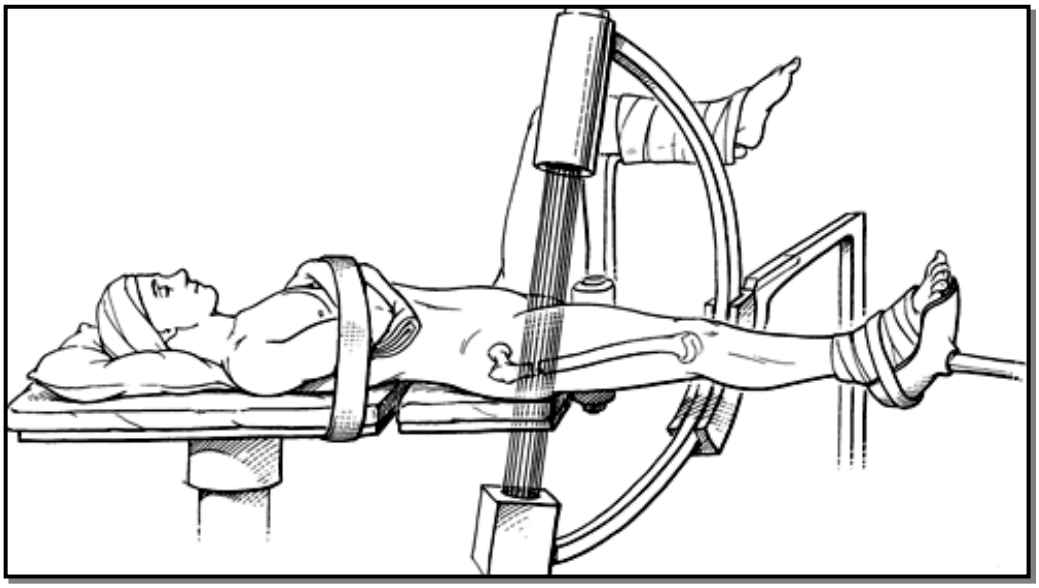


Fig – 14 : Showing Fracture Table

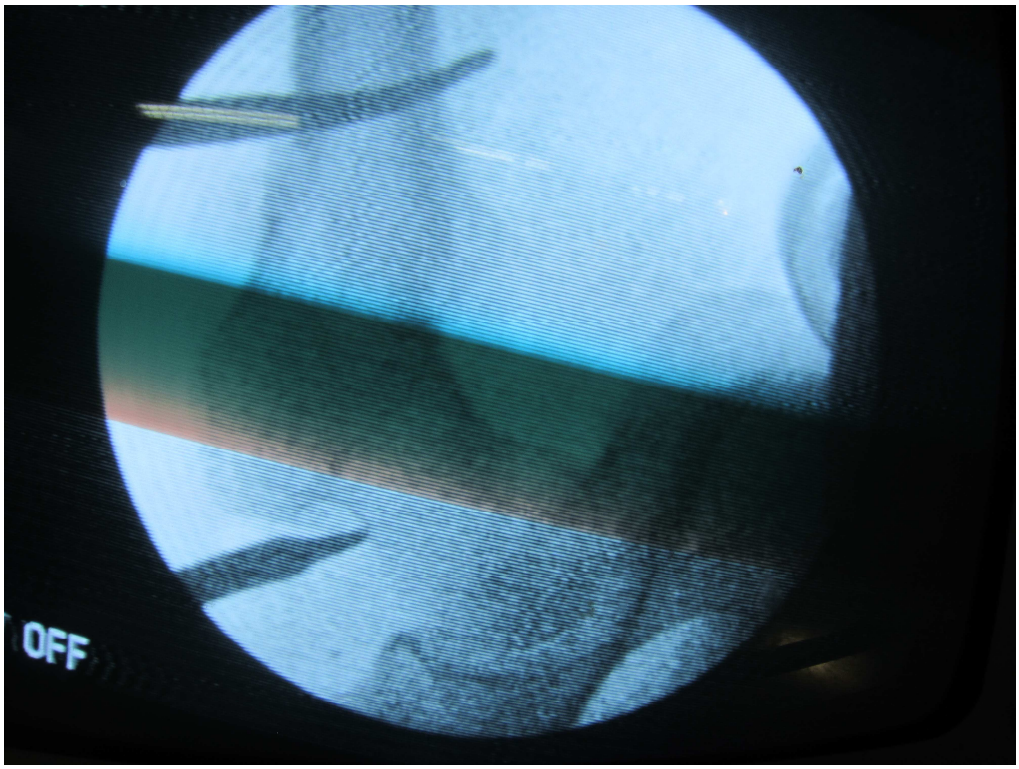


Fig – 15 : Showing Reduction with Artery Forceps

INCISION

The approach for PFN was a 5 cm incision extending proximally from the tip of the greater trochanter followed by parallel incision of fascia lata and gluteus medius was split in the line of fibres. Tip of greater trochanter was exposed.

Fig – 16 : Showing Incision of Entry point

ENTRY POINT

The point of entry was just medial to tip of the greater trochanter at the mid point in the anteroposterior diameter and was made with a curved awl under c- arm guidance.

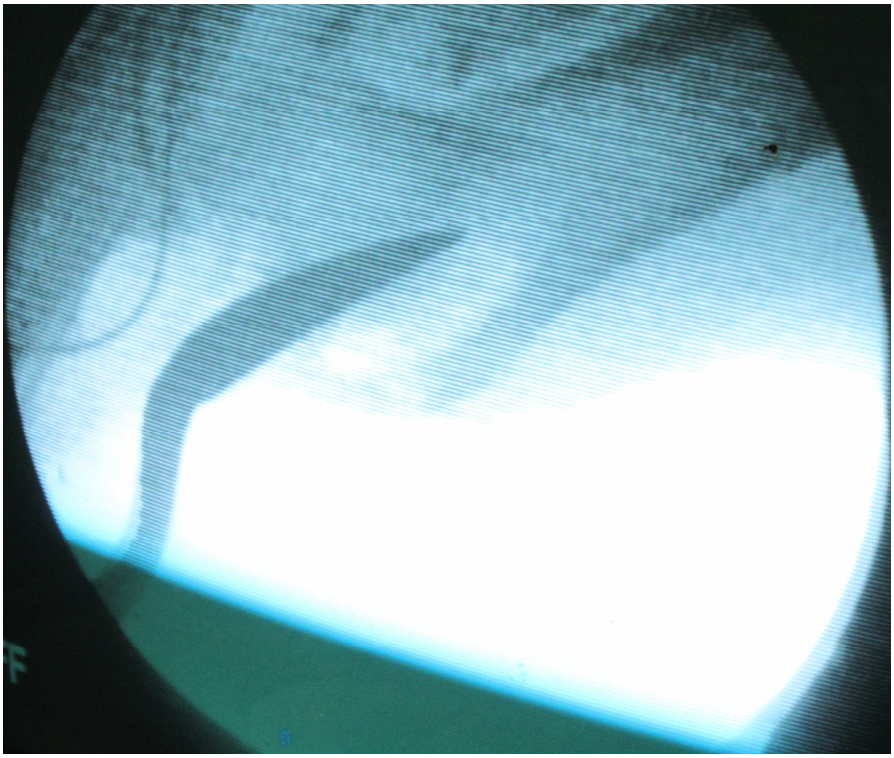


Fig – 17 : Entry point with AWL

All the fractures were treated with initial closed reduction with alignment of the medial cortex. In four patients we could not achieve closed reduction and in those cases open reduction was done.

GUIDE WIRE INSERTION & REAMING

The guide wire is inserted using a tissue protector. The position of guide pin is checked in AP and lateral views. Entry point is reamed using 15mm entry point reamer and distal reaming of canal is done with graded cannulated reamers, when ever necessary.

NAIL INSERTION & PROXIMAL TARGETING

The nail was inserted with the help of the jig over the guide wire. Fluoroscopic images were taken when the nail is being introduced to check for any peroperative femoral fractures. The nail along with the jig was inserted by hand by gentle twisting movements. Once the nail was positioned appropriately the guide wire was removed and drill sleeve were attached to the jig and through a stab incision over lateral thigh the drill sleeves was pushed up to the lateral cortex one for compression screw and one for derotation screw. The guide pin was then passed into the head & neck using guide pin sleeve. The guide pins were advanced upto 5-10 mm short of articular surface of femoral head.

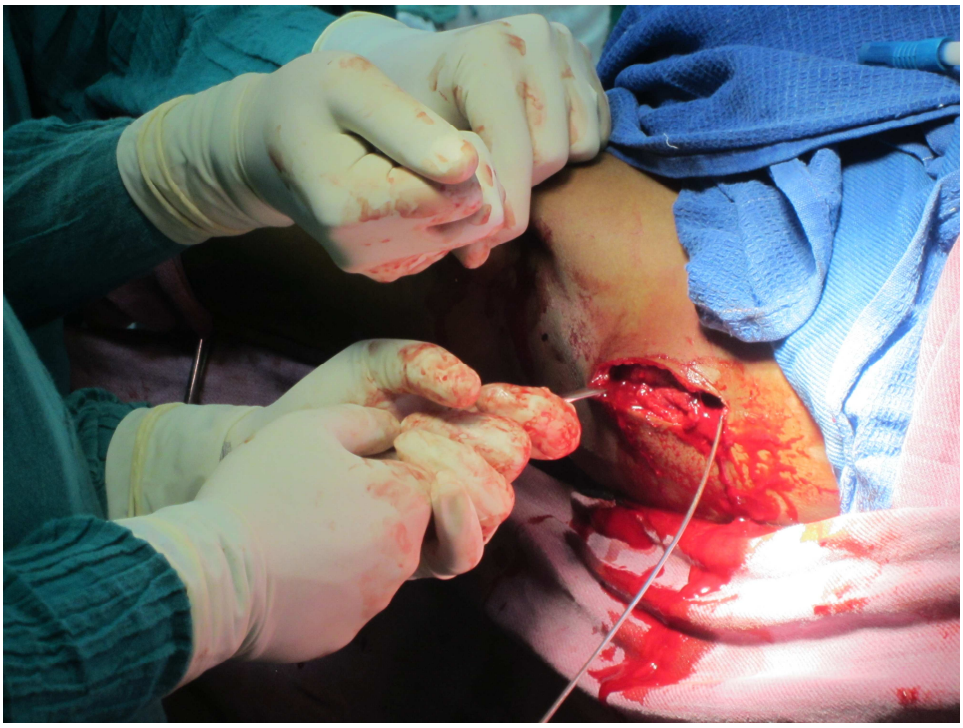


Fig – 18 : Showing Insertion of Guide Wire

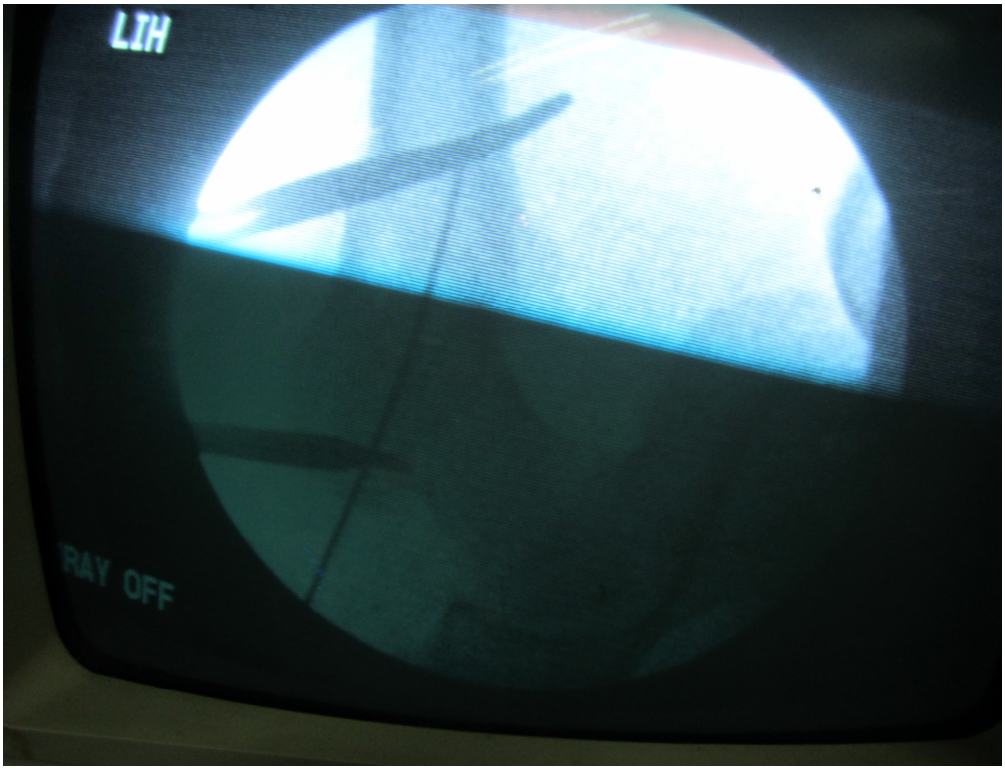


Fig – 19 : Showing C-arm picture with Guide Wire

Proximal locking with the hip pin along the superior part of the neck was done first followed by the inferior lag screw of appropriate length as measured preoperatively & peroperatively .The hip pin should be 15-20 mm shorter than lag screw

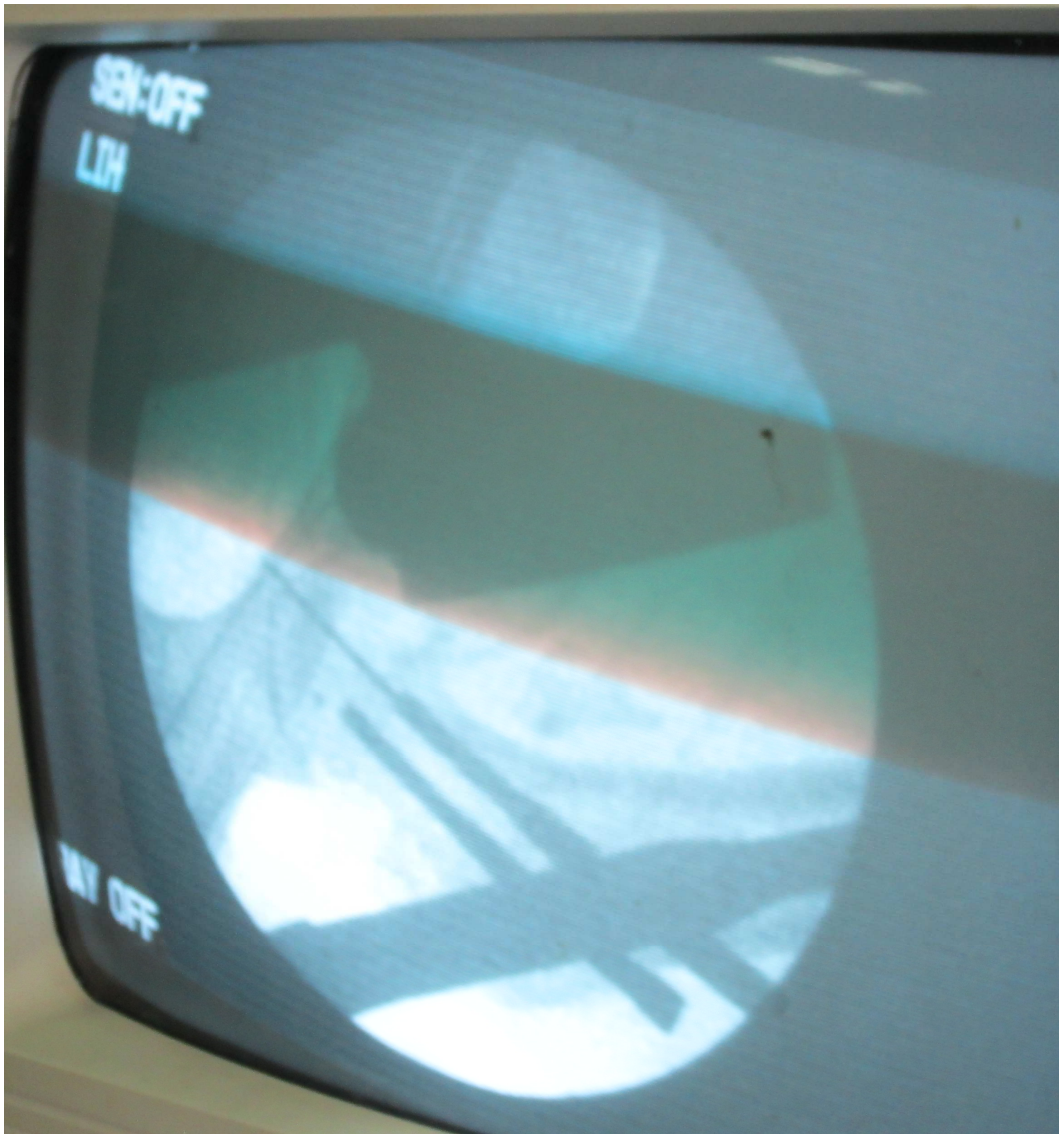


Fig – 20 : Showing C-arm picture with hip pin and lag screw

DISTAL TARGETING

Distal locking was also done with the aid of jig and two distal locking screws and position checked with C-arm

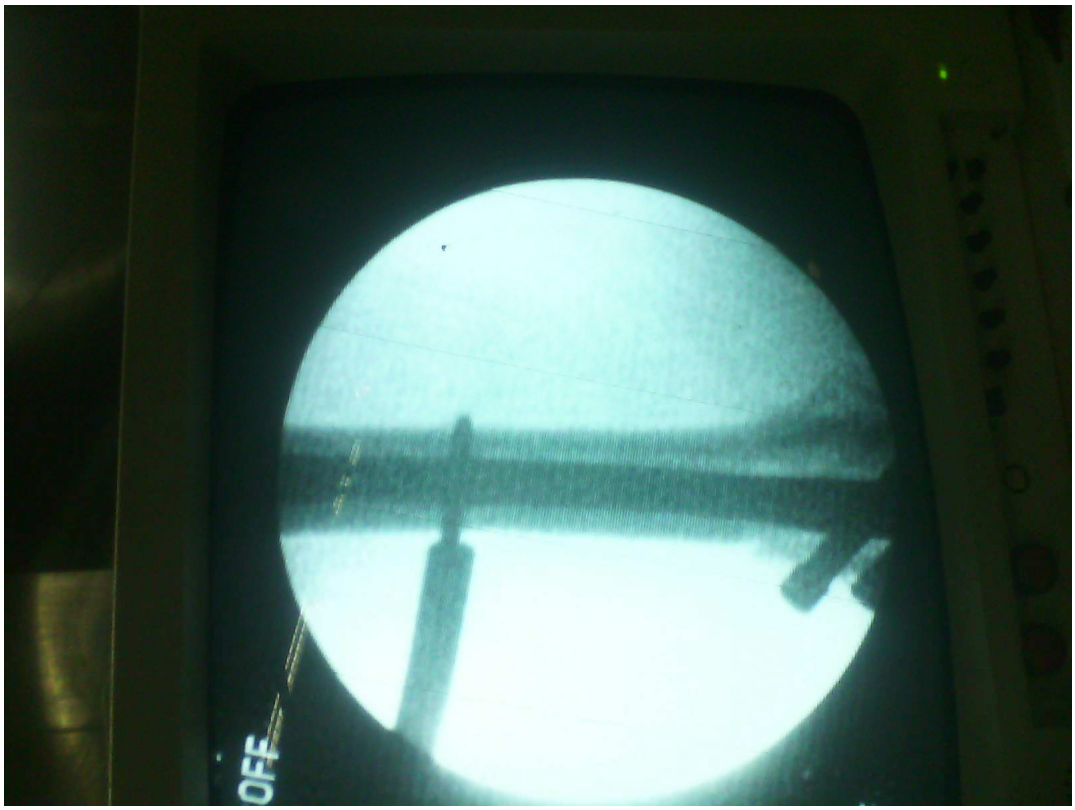


Fig – 21 : C-arm picture showing distal locking

Wound was closed in layers and suction drain was not used in cases with closed reduction and used in cases in which open reduction was done.Operating time was calculated from the start of surgical incision to wound closure and the duration of image intensifier in patient treated with the PFN was calculated in seconds. Blood loss was calculated from the number of surgical mops that were used, each mops corresponding to 50ml of blood added with it the amount of blood collected in suction apparatus.

POSTOPERATIVE CARE

The mobilization of hip fracture patients out of bed begin and ambulation training was initiated on postoperative day one. Furthermore, any patient who has been surgically treated for an intertrochanteric fracture was allowed to bear weight as tolerated.

All patients were given intravenous antibiotics for three days postoperatively. Postoperatively NSAIDS were avoided and opioids were given for pain relief.

Restricted weight bearing after hip fracture has little biomechanical justification, since activities such as moving around in bed and use of a bedpan generate forces across the hip approaching those resulting from unsupported ambulation. Even foot and ankle range-of-motion exercises performed in bed produce substantial loads on the femoral head secondary to muscle contraction.

Several studies have demonstrated that unrestricted weight bearing does not increase complication rates following fixation of intertrochanteric fractures.

Time for fracture healing was evaluated according to radiographic and clinical criteria. Clinically Union was observed as the absence of Tenderness (or) pain with full weight bearing.

Functional outcome was studied with Harris hip score.

FOLLOW UP EVALUATION

All patients were reviewed by a single observer. Radiographs were reviewed monthly for fracture union and to assess fracture alignment. Bony union was defined in both clinical and radiological means. The functional outcome of the patients were evaluated with Harris hip Score. During every review the patient were evaluated and score given from 0 to 100.Those who score on and above 90 fall in excellent category & those below 70 are termed poor outcome group. The other two category are good and satisfactory if there scores were 80-89 and 70-79 respectively.

OBSERVATION

AND

RESULTS

OBSERVATION AND RESULTS

The following observations were made in the study

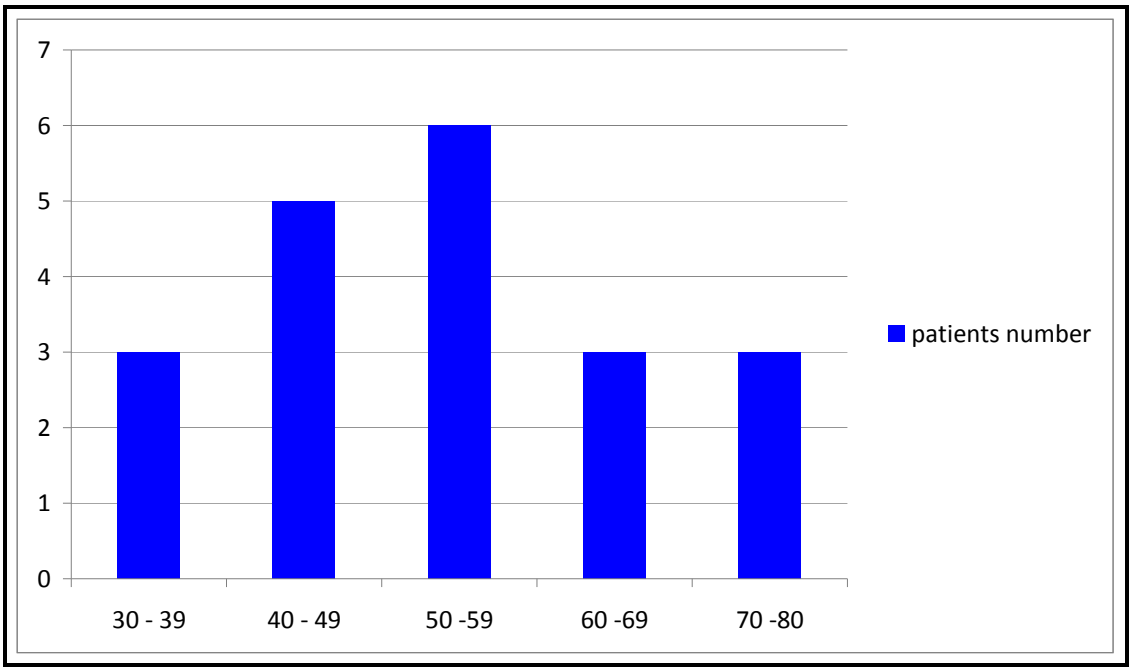
AGE GROUP PATTERN

In our study we found that majority of them are in fifth decade.

Average age of our patients was 54.8

AGE GROUP	PFN	
	NO.	%
30 -39	3	15
40 – 49	5	25
50 – 59	6	30
60 – 69	3	15
70 – 80	3	15
TOTAL	20	100
MEAN		**54.8**

AGE GROUP

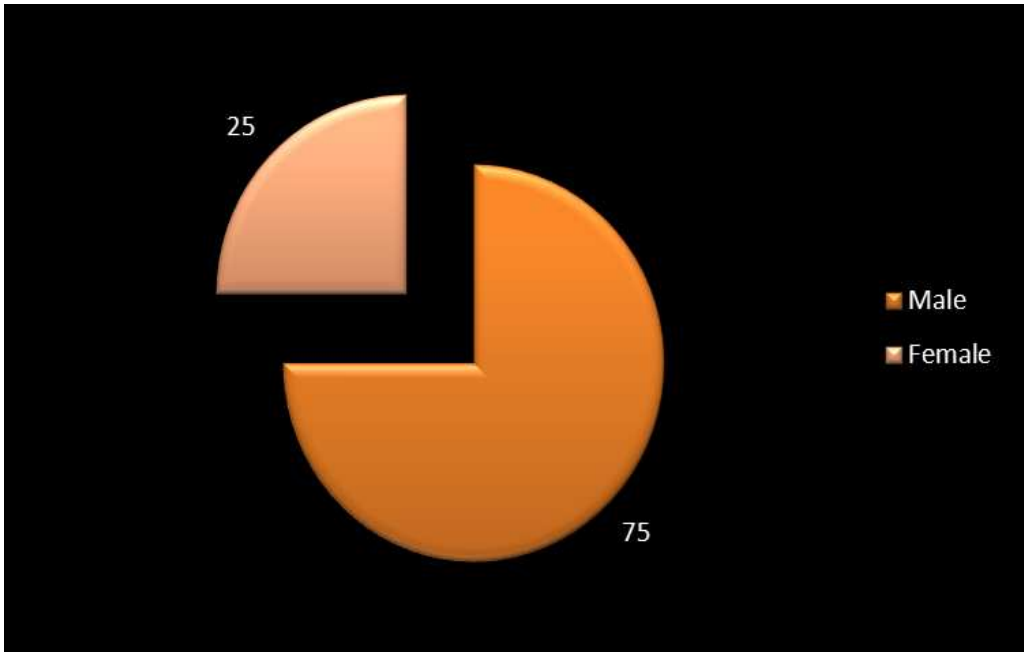


SEX RATIO

It was males who predominated our study.75% of the total patients were males and 25% of them were females.

SEX	PFN	
	No	**%**
MALE	15	75
FEMALE	5	25

SEX RATIO

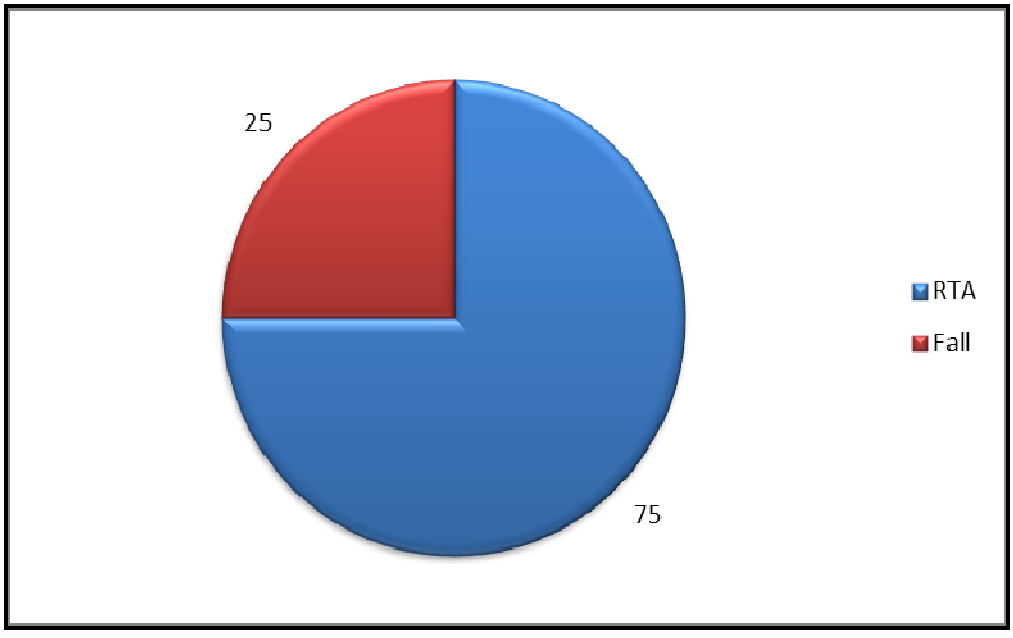


MODE OF INJURY

In our study we found that Road traffic accident was the major cause of injury(75%) and self fall was the cause in 25% of patients

Mode	PFN	
	No	%
RTA	15	75
ACCIDENTAL FALL	5	25

MODE OF INJURY

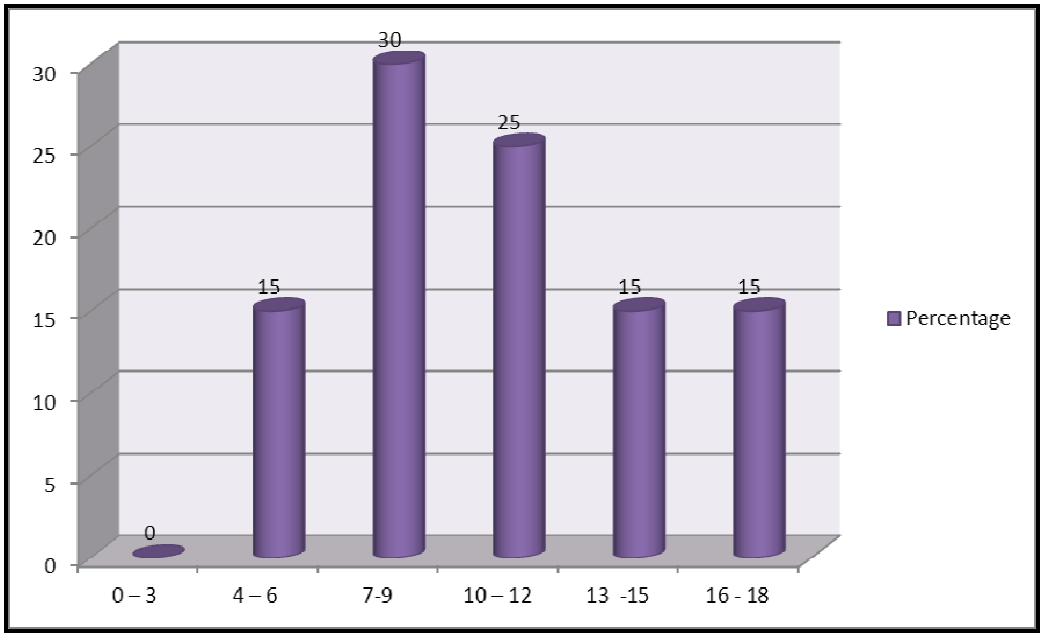


INTERVAL BETWEEN INJURY & SURGERY

We have studied the interval between injury and time of surgery. Most of the surgeries were done after 7 days and average time interval was found to be 10.2 days.

INTERVAL IN DAYS	PFN	
	No	%
0 – 3	0	0
4 – 6	3	15
7 – 9	6	30
10 – 12	5	25
13 -15	3	15
16 – 18	3	15
Mean Duration - 10.2 days		

INTERVAL BETWEEN INJURY & SURGERY

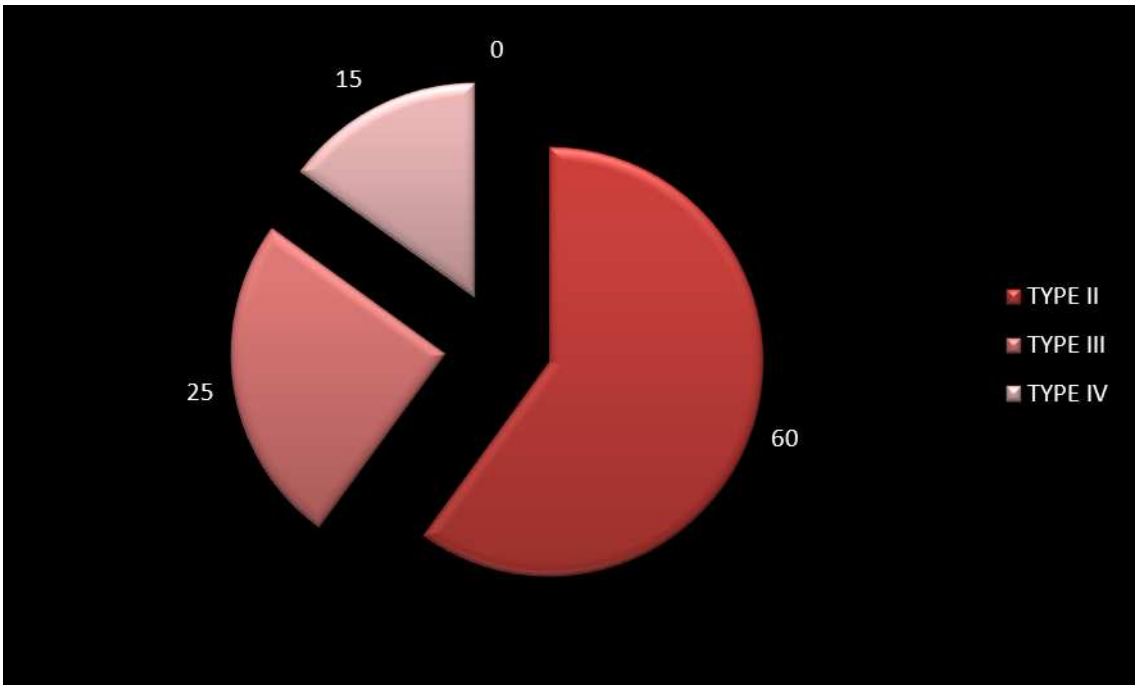


CLASSIFICATION

In our study we observed that 60% of the unstable intertrochanteric patients admitted were Type II and 25% were type III and 15% were type IV.

BOYD & GRIFFIN CLASSIFICATION	Case	
	No	%
TYPE II	12	60
TYPE III	5	25
TYPE IV	3	15

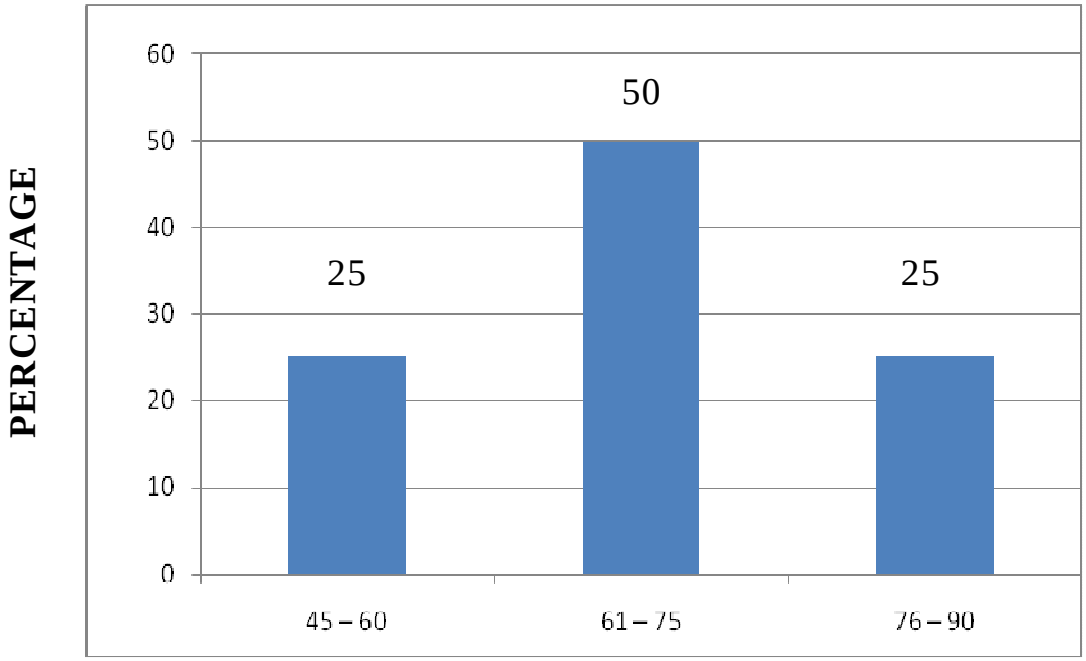
CLASSIFICATION



OPERATING TIME

The average operating time was found to be 67.8 minutes.

OPERATING TIME (MIN)	Cases	
	No	%
45 – 60	5	25
61 – 75	10	50
76 – 90	5	25
Mean-67.6 minutes		



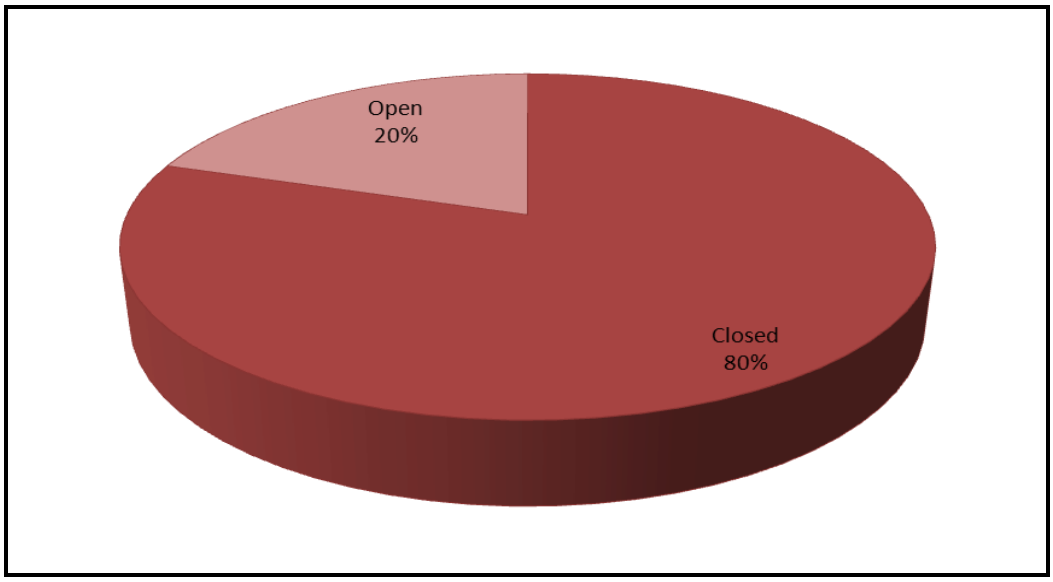
Operating Time In Minutes

METHOD OF REDUCTION

Out of the 20 patients operated we could able to do closed reduction in 80% of patients and in 20% of patients open reduction was done. Out of 12 cases of type II ,11 cases were closely reduced and in 1 case open reduction was done. In 5 cases of Type III all are closely reduced and in all cases of Type IV open reduction was done.

Method of Reduction	Boyd & Griffin Classification		
	Type II	Type III	Type IV
Closed (16)	11	5	0
Open(4)	1	0	3

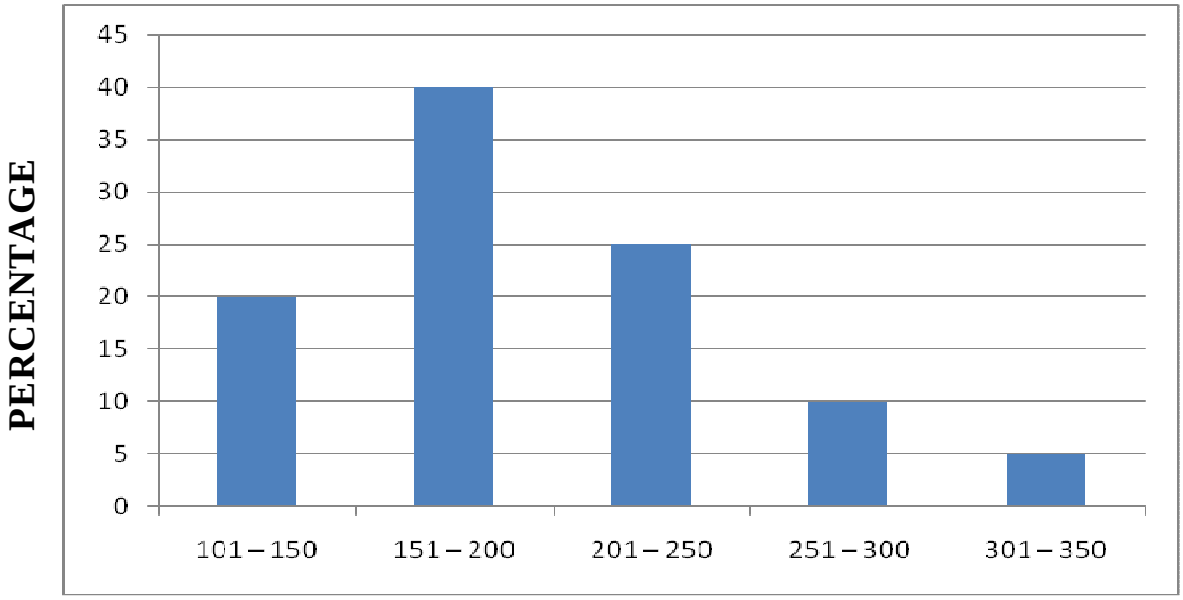
METHOD OF REDUCTION



BLOOD LOSS

Blood loss during surgery was calculated by number of pads used (each 50 ml) and blood collected in suction apparatus. We found that Average blood loss was 187 ml and blood loss was more in cases with open reduction than closed reduction.

BLOOD LOSS (ml)	PFN	
	No	%
101 – 150	4	20
151 – 200	8	40
201 – 250	5	25
251 – 300	2	10
301 – 350	1	5
MEAN LOSS - 187 ml		

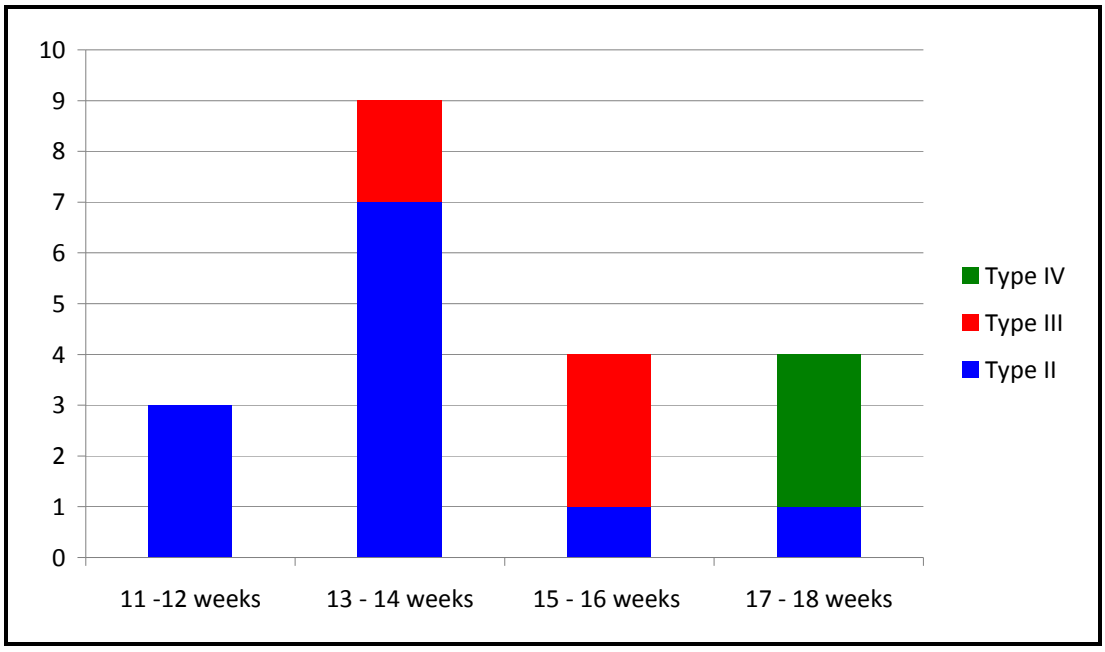


TIME FOR FRACTURE UNION

The time for fracture union ranged from 12 to 18 weeks and the average time for union is 14.6 weeks. In open reduction cases the time for union is from 17 to 18 weeks and in closed reduction cases the union is from 12 to 16 weeks.

Weeks	Boyd and Griffin Types		
	Type II	Type III	Type IV
11 – 12	3	0	0
13 – 14	7	2	0
15 – 16	1	3	0
17 -18	1	0	3

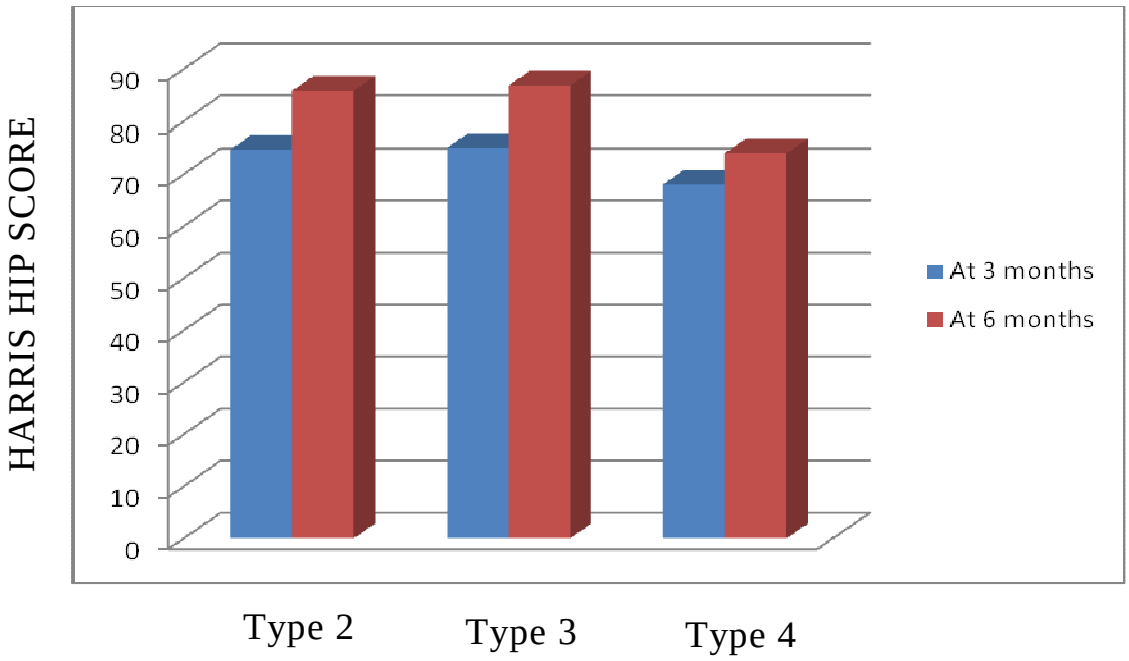
TIME FOR UNION IN WEEKS



HARRIS HIP SCORE EVALUATION

Harris hip score evaluation was done during every followup period. At 3 months followup the average score was 73.8(range 66-81) and at 6 months it was 84.3(Range 72-94).

Average Harris hip score	Type II	TypeIII	Type IV
At 3 months	74.7	75	68
At 6 months	85.8	86.8	74



Operative time varied from 43 minutes to 90 minutes with average of 67.6 minutes Blood loss varied from 130 ml to 325 ml with mean loss of 187ml.

The age group varied from a minimum of 33 years to a maximum of 80 years and average age was 54.8 years. Duration of the study was from March 2012 to August 2013.Maximum follow up is 18 months and minimum followup is 3 months. Mean follow up was 10 months. of the 20 patients 15 were male and five were female. Right side was involved in 12 cases and Left side in 8 patients. 16 patients were manual laborers, four were sedentary workers.

The average interval from the injury to the time of surgery was 10.2 days.

All the patients were managed initially with skeletal traction before taking up for surgery.

Patients were evaluated clinically and radiologically at 3 weeks interval for first 3 months and there after monthly for the next 3 months and bimonthly for next 12 months.

RADIOLOGICAL OUTCOME

Average union time in weeks is 14.6 weeks.(Range 12 to 18 weeks). In our series union was delayed in all type IV cases(17- 18 weeks).

FUNCTIONAL RESULT

Harris hip Score at the end of 3 month is 73.8 and at end of 6 months is 84.3. Sixteen patients who were manual laborers went back to their original work.At the end of 6 months the result was Excellent in 5 cases .Good in 11 cases, fair in 3 cases and poor in 1 case. None of the patients developed thigh pain.

We have not encountered post operative ‘Z’ effect and femoral shaft fracture at the tip of the nail in our follow up.

ASSOCIATED INJURIES

Fracture of radius was found in one case on same side for which open reduction and internal fixation with Asian DCP was done.

Fracture of condyle of mandible was seen bilaterally in one case which was Operated after orthopaedic intervention.

COMPLICATIONS

1. Complication were encountered intraoperatlvely in one case with breakage of the reamer of lag screw, which was left alone.

2. Abductor lurch was seen in one case postoperatively

3. Superficial wound infection was seen in one case which settled down with antibiotics.

CASE

ILLUSTRATIONS

CASE ILLUSTRATION -1

PRE OPERATIVE EVALUATION:

Name: Doss

Age/ Sex:57/M

IP No: 54362

Mode of injury: RTA

Time from injury to surgery: 4 days

Co-morbid illness: Nil

Associated injuries: Nil

Boyd and griffin classification- Type II

SURGICAL EVALUATION:

Time from admission to surgery: 4 days

Duration of surgery: 45 minutes

Position: supine in fracture table

Anaesthesia: spinal

Blood loss-110 ml

Method of reduction- closed

Lag screw size- 85 mm

Hip pin size – 65 mm

POST OPERATIVE EVALUATION:

Follow up period: 1 yr & 6 month

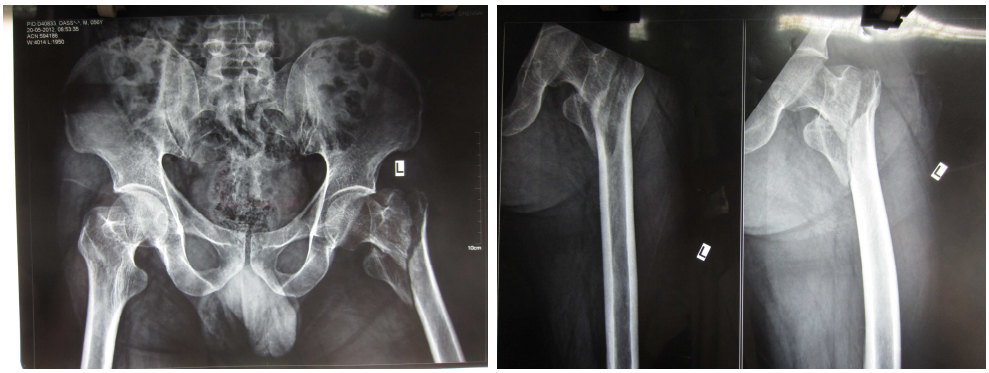
Harris hip score

At 3 months-81

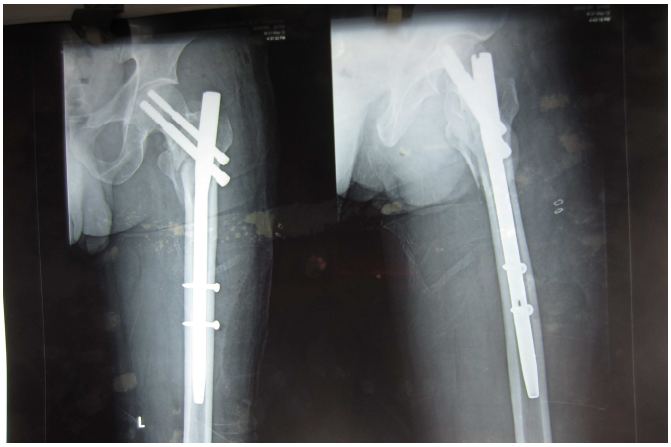
At 6 months-94

Time for fracture union-12 weeks

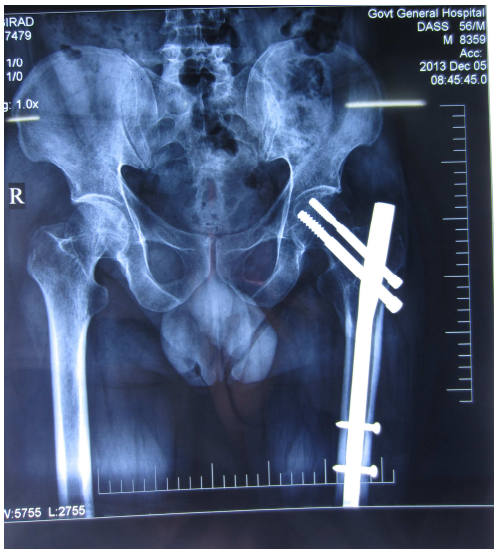
Pre op



Postop



18 months followup



Clinical photos

CASE ILLUSTRATION -2

PRE OPERATIVE EVALUATION:

Name: Gunapriya

Age/ Sex:48/F

IP No: 55621

Mode of injury: RTA

Time from injury to surgery: 8 days

Co-morbid illness: Nil

Associated injuries: Nil

Boyd and griffin classification- Type III

SURGICAL EVALUATION:

Duration of surgery: 65 minutes

Position: supine in fracture table

Anaesthesia: spinal

Blood loss-160 ml

Method of reduction- closed

Lag screw size- 85 mm

Hip pin size – 70 mm

POST OPERATIVE EVALUATION:

Follow up period: 1 yr

Harris hip score

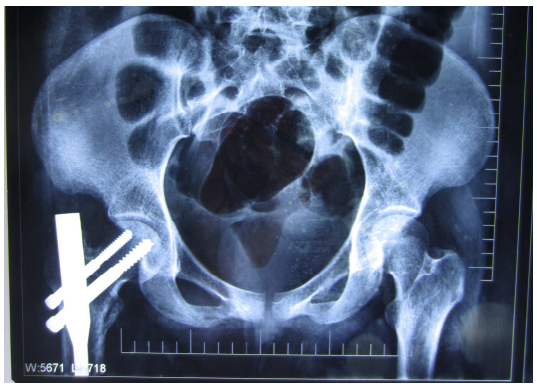
At 3 months-78

At 6 months-86

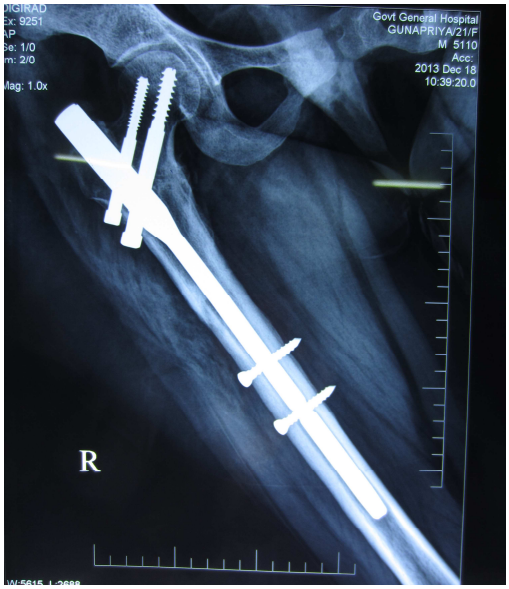
Time for fracture union-13 weeks

Preop

Postop



8 months followup



Clinical photos

CASE ILLUSTRATION -3

PRE OPERATIVE EVALUATION:

Name: Premkumar

Age/ Sex:23/M

IP No: 60342

Mode of injury: RTA

Time from injury to surgery: 12 days

Co-morbid illness: Nil

Associated injuries: Fracture of Mandible

Boyd and griffin classification- Type III

SURGICAL EVALUATION:

Duration of surgery: 65 minutes

Position: supine in fracture table

Anaesthesia: spinal

Blood loss-160 ml

Method of reduction- closed

Lag screw size- 90 mm

Hip pin size – 75 mm

POST OPERATIVE EVALUATION:

Follow up period: 1 yr 2 months

Harris hip score

At 3 months-76

At 6 months-84

Time for fracture union-14 weeks

Preop

Postop

10monthsfollowup

Clinical photo

CASE ILLUSTRATION – 4

Complication – Breakage Of Reamer Of Lag Screw

DISCUSSION

DISCUSSION

The PFN is an effective intramedullary load - sharing device. Biomechanically Proximal femoral nail is more stiff, it has shorter moment arm i.e. from the tip of lag screw to the center of femoral canal whereas the DHS has a longer moment arm undergoes significant stress on weight bearing and hence higher incidence of Lag screw cut out and varus malunion[2]. The larger proximal diameter (15 mm) of the PFN given additional stiffness to the nail.

The incidence of intertrochanteric fractures are of increasing trend due to road traffic accident. In our study 75% of cases are due to road traffic accident and 25% of them are due to self fall. 75% of people are males and 25% are females in our study. The average age in our study is 54.8 years. The average age in Minos Tyllianakis[12], W.M.Gadegone[15], Shrinivas Kalligudi[17], Ranjeetesh kumar[2] studies are 72, 69, 55.18, 62.3 years respectively. Our study is comparable with Shrinivas study with average age of 55.18 with male predominance and RTA being main cause of injury. In other studies self fall is main cause of injury and average age is also more than our study which indicates that self fall increases with increasing age.

	Minimum age	Maximum age	Average age
Minos Tyllinakis	45	88	72
W.M.Gadegone	33	82	69
Shrinivas	22	94	55.18
Ranjeetesh	40	86	62.3
Our study	33	80	54.8

The average time interval between injury and surgery was 10.7 days (4-18 days) in our study whereas it was 3 and 2 days in Minos Tyllinakis and W.M Gadegone studies respectively.As the case load in our government hospital is more,we could not post the case earlier.Open reduction was done in 20% of cases in our study but it was 6% and 14% in Minos Tyllinakis and Gadegone study respectively.This indicates that as the time interval between injury and surgery increases the chances of open reduction also increases. So it is better to take the case as early as possible to avoid open reduction.Even though more open reduction was done in our seriesthe functional and radiological results are comparable with other studies done by Minos Tyllinakis and W.M Gadegone

Most of the cases in our study are Type II Boyd and Griffin classification (60%) and it is comparable with studies by Shrinivas Kalligudi[17] and Goswami[19] in which Type II predominates.

In our study we did not encounter Z effect in any case. But it was seen in 3% of cases in study by W.M gadegone and 14% of cases in M.Tyllinakis. The cause given for Z effect is due to non anatomic reduction and improper size of proximal screws .In all our cases hip pin is inserted of size 15 -20 mm lesser than the lag screw. Hence proper reduction and appropriate screw size insertion can prevent Z effect.

Average blood loss in our study is 187 ml (range-110 to 320 ml) and blood loss is more in cases in which open reduction was done. The average operating time was 68 minutes (45 to 90 minutes) and it was more in cases in which open reduction was done. Hence closed reduction can reduce the operating time and blood loss during surgery.

The average time for union in our study is 14.6 weeks(range 12-18 weeks) and it was 16.5 ,18 weeks in shrinivas Kalligudi and W.M Gadegone studies respectively. Since we did not encounter implant failure in any case the average time for union is less when compared to other studies.

The Modified Harris hip score in our study is 84.3 at the end of 6 months and it is comparable with other studies. The harris hip score was 88,84,83.5 in Ranjeetesh kumar, Gadegone and Shrinivas studies respectively.

Peroperative and postoperative femoral fractures have been documented in studies in patients treated with the PFN. Multiple factors have been implicated like implant design and operative technique. Decreases in implant curvature, diameter, over reaming of femoral canal by 1.5 to 2mm, insertion of the implant by hand and meticulous placement of the distal locking screws without creating additional stress risers decreases the complication rate of femoral shaft fracture (I.B. Schipper et.al. 2004). Patients with narrow femoral canal and abnormal curvature of the proximal femur are relative contra-indications to intramedullary implants (Halder et.al 1992). We have followed these recommendations in our series. Hence in our series we don’t have encountered any preoperative and postoperative femoral shaft fractures. A larger cohort of patients is necessary to document the incidence of preoperative and postoperative femoral shaft fractures, which is a limitation of our study.

In our series the incidence of abductor lurch in the post operative period was 5%. Gluteus medius tendon injury has been reported in 27 % patients with the use of Trochantric entry nails (Mc Connell et. al. 2003). The abductor lurch may improve in many numbers of patients and may remain static in some patients. Since the follow– up period of this study is short which is a limitation of our study, we could not definitely quantify the number of patients who developed permanent damage to abductor musculature.

CONCLUSION

CONCLUSION

Proximal femoral nail is an excellent device for unstable intertrochanteric fractures and it is technically demanding procedure. Proper reduction, correct entry point of nail , placement of neck screws of adequate length determines the outcome of surgery.The results are better if surgery is done earlier.

Early mobilization and weight bearing is allowed in patients treated with Proximal femoral nail thereby decreasing the incidence of bedsores, uraemia and hypostatic pneumonia.

Proximal femoral nail is a significant advancement in the treatment of unstable trochanteric fractures which has the unique advantage of closed reduction, preservation of fracture hematoma, less tissue damage during surgery, early rehabilitation and early return to work.

When properly done Proximal femoral nail can give better results than other devices for unstable intertrochanteric fractures.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Hip fracture epidemiological trends, outcomes and risk factors. 1970-2009, Ray marks
2. Ranjeetesh Kumar, Comparitive prospective study of proximal femoral nail and dynamic hip screw in treatment of intertrochanteric fracture femur
3. Gulberg et al, management of fractures in severely osteoporotic bones
4. Cooper AA, treatise on dislocation and fractures of the joints, London England
5. Cotton FJ (1911) artificial impaction in hip fractures, American journal of orthopaedic study,8,680
6. Jewett el one piece angle nail for trochanteric fractures JBJS am 1941; 23; 808-10
7. Zickel RE, a new fixation device for subtrochanteric fractures of femur, a preliminary report, clin orthop 1967; 54; 115-23
8. Werner et al, analysis of treatment problems in intertrochanteric fractures
9. S.C Halder the gamma nail for peritrochanteric fractures
10. Treatment of unstable trochanteric fractures comparision of gamma nail and proximal femoral nail I.B Schipper

11. Fixation of intertrochanteric fractures of femur.a randomised prospective comparision of gamma nail and dynamic hip screw ; H.Bridle
12. Treatment of Extracapsular hip fractures with the proximal femoral nail(pfn); long term results in 45 patients
13. Long term radiographic complications following treatment of unstable intertrochanteric femoral fractures with the proximal femoral nail and effects of functional results;Metin Uzun
14. Proximal Femoral Nail versus Dynamic Hip Screw Fixation for rochanteric Fractures : A Meta-analysis of Randomized Controled Trails; Xiao Huang, Frankie Leung.
15. Proximal Femoral nail – An Analysis of 100 cases of proximal femoral fractures with an average follow up of 1 year. W.M.Gadegone, Y.S.Salphale.
16. Proximal Femoral Nailing : Technical Difficulties and Results in Trochanteric Fracturers":. Janardhana Aithala P.Sharath Rao.
17. Proximal Femoral Nail in the Mangement of Peritrochanteric Fractures Femur and its Functional Outcome. Shrinivas Kalliguddi, Veerabhadra Jawali and Reneesh Up.
18. A Hypothesis : the causes of hip fracture cummings SR, Nevitt MC.
19. Effect of Proximal Femoral Nailing in Proximal Third Femur Fracture. Ashutosh Goswami, Umesh Chaudhari, Bhavik Dalal, Archit Gandhi.

20. Proximal Femoral nail for treatment of trochanteric femoral fractures. T.Morihara

21. Pertrochanteric fractures : Is there an advantage to an intramedullary nail? : a randomized, Prospective study of 206 patients comparing the dynamic hip screw and proximal femoral nail. Saudan M.

22. The AO / ASIF – Proximal Femoral nail (PFN) : a new device for the treatment of unstable proximal femoral fractures. Simmermacher RK Bosh A M.

ANNEXURE

PROFORMA

Name : Age: Sex:

Address: Ph.No:

IP No. Unit: DOA: DOS : Ward:

Mode of Injury: Side of Injury: Rt. / Lt.

Associated Injuries : Head / Abdomen / Pelvis / other limb injuries

Boyd and Griffin Classification

Investigation

Plain X- Ray Pelvis AP and Lateral views Urine albumin /sugar

Blood Hb / Urea / Sugar / Grouping and typing

Chest X -ray

ECG

INITIAL MANAGEMENT

Improvement of General Condition

Closed reduction / Upper tibial pin traction / Bohler Braun splint Details of other treatment particulars

SURGERY

Interval between injury and surgery Patient positioning

Operating time Entry Portal

Method of fracture reduction Type of implant

Length and diameter ofnail Length of lag screw

Length of hip pin

Details of distal locking

Amount of blood loss / blood transfusion Fluoroscopic exposure (in seconds)

COMPLICATIONS

Improper placement of nail splitting of entry site

Varus positioning

Peroperative femoral shaft fracture

Failure of distal locking

Early Postoperative -Infection

Abductor lurch

CLINICAL AND RADIOLOGICAL ASSESSMENT DURING FOLLOW UP PERIOD

Fracture union at	-	weeks
Harris hip score	-	At every visit

HARRIS HIP SCORE (MODIFIED)

Maximum points possible - 100

☐ Pain relief- 44

☐ Function- 47

☐ Absence of deformity- 4

☐ Range of motion- 5

Pain (44 Possible)

- None or ignores it (44)
- Slight, occasional, no compromise inactivities (40)
- Mild pain, no effect on average activities,rarely moderate pain with usual activity;may take aspirin (30)
- Moderate pain, tolerable but makesconcessions to pain, some limitation of ordinary activity or work; may requireoccasional medicine stronger thanaspirin(20)
- Marked pain, serious limitation ofactivities (10)
- Totally disabled, crippled, pain in bed, bed ridden

Function (47 Possible)

Gait (33 POSSIBLE)

Limp

- None (11) - Slight (8) - Moderate (5)- Severe (0)

Support

- None (11 - Cane for long walks (7) - Cane most of the time (5)

Onecrutch(3)- Two canes (2)

Two crutches (0)- Not able to walk (0)

Distance Walked

- Unlimited (11) - Six blocks (8) - Two or three blocks (5)
- Indoors only (2) - Bed and chair (0)

Activities (14 Possible)

Stairs

- Normally without use of railing (4) - Normally use of railing (2)

- In any manner (1) - Unable to do stairs (0)

Shoes and Socks

- With ease (4)- With difficulty (2)
- Unable (0)

Sitting

- Comfortably in ordinary chair one hour (5)
- On a high chair for half an hour (3)
- Unable to sit comfortably in any chair (0)

Enter Public Transportation (1)

(3) Abscense of deformity (All yes = 4; Less than4 = 0)

- Less than 30 degrees of fixed flexioncontracture.
- Less than 10 degrees of fixed adduction.
- Less than 10 degrees of fixed internalrotation in extension.
- Limb length discrepancy less than 3.2 cm.

(4) Range of motion (5 Possible) (* Normal)

Total degree measurements, then check range to obtain score

- Flexion (*140 degrees)- Abduction (*40)- Adduction (*40)
- External rotation (*40)- Internal rotation (*40)

Range of motion scale

210-300 (5) 161-210 (4) 101-160 (3) 61-100 (2) 31-60 (1) 0-30 (0)

INFORMATION SHEET

TITLE: ANALYSIS OF CLINICAL, RADIOLOGICAL AND FUNCTIONAL OUTCOME OF PROXIMAL FEMORAL NAILING IN UNSTABLE INTERTROCHANTERIC FRACTURE

Name of the Investigator :
Name of the Participant :

We are conducting a study on **"Analysis of Clinical, Radiological and Functional Outcome of Proximal Femoral Nailing in Unstable Intertrochanteric Fracture"** among patients attending the Institute of Orthopaedics & Traumatology, Rajiv Gandhi Government General Hospital, Chennai.

The purpose of this study is to evaluate and analyse the clinical, radiological and functional outcome of proximal femoral nailing in unstable intertrochanteric fractures.

We are selecting certain cases and if you are found eligible, we will perform the surgery and we may be using your radiographs of the pelvis, hip to evaluate the outcome of surgery which in any way do not affect your final report or management.

The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled.

The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of Investigator **Signature of Participant**

Date

PATIENT CONSENT FORM

Study Detail	:	"Analysis of Clinical, Radiological and Functional Outcome of Proximal Femoral Nailing in Unstable Intertrochanteric Fracture"
Study Centre	:	Rajiv Gandhi Government General Hospital, Chennai.
Patient's Name	:	
Patient's Age	:	
Identification Number	:	

Patient may check (√) these boxes

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction. ❑

I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. ❑

I understand that sponsor of the clinical study, others working on the sponsor's behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study. ❑

I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well being or any unexpected or unusual symptoms. ❑

I hereby consent to participate in this study. ❑

I hereby give permission to undergo detailed clinical examination, Radiographs & blood investigations as required. ❑

Signature/thumb impression

Patient's Name and Address:

Signature of Investigator

Study Investigator's Name: Dr. SIVAKUMAR.P

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI-3

EC Reg No.ECR/270/Inst./TN/2013
Telephone No : 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr. Sivakumar .P,
PG in MS Orthopaedics,
Institute of Orthopaedics & Traumatology,
Madras Medical College, Chennai-3.

Dear Dr. Sivakumar .P,

The Institutional Ethics Committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled **"Analysis of clinical radiological and functional outcome of proximal femoral nailing in unstable intertrochanteric fractures"** No.34102013.

The following members of Ethics Committee were present in the meeting held on 08.10.2013 conducted at Madras Medical College, Chennai-3.

1. Dr. G. Sivakumar, MS FICS FAIS	-- Chairperson
2. Prof. R. Nandini, MD Director, Instt. of Pharmacology, MMC, Ch-3	-- Member Secretary
3. Prof. Ramadevi, Director i/c, Instt. of Biochemistry, Chennai.	-- Member
4. Prof. P. Karkuzhali, MD Prof. Instt. of Pathology, MMC, Ch-3	-- Member
5. Prof. Kalai Selvi, MD Prof. of Pharmacology, MMC, Ch-3	-- Member
6. Thiru. S. Govindasamy, BABL	-- Lawyer
7. Tmt. Arnold Saulina, MA MSW	-- Social Scientist

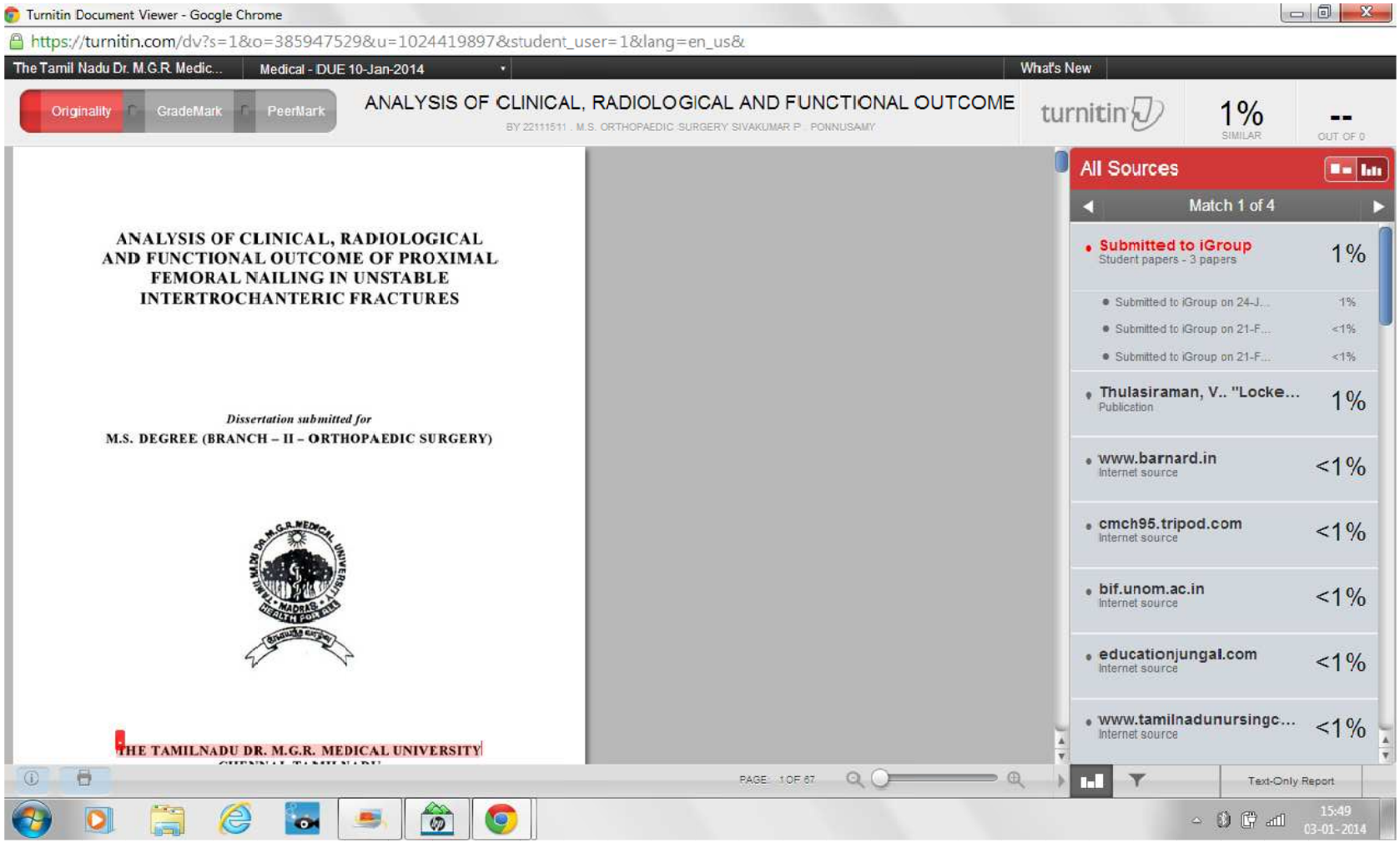
We approve the proposal to be conducted in its presented form.

Sd/Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

R Nandini
Member Secretary, Ethics Committee

CHAIRMAN
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003


Turnitin Document Viewer - Google Chrome
https://turnitin.com/dv?s=1&o=385947529&u=1024419897&student_user=1&lang=en_us&
The Tamil Nadu Dr. M.G.R. Medic...
Medical - DUE 10-Jan-2014
What's New
Originality
GradeMark
PeerMark
ANALYSIS OF CLINICAL, RADIOLOGICAL AND FUNCTIONAL OUTCOME
BY 22111511 . M.S. ORTHOPAEDIC SURGERY SIVAKUMAR P . PONNUSAMY
turnitin
1%
SIMILAR
--
OUT OF 0
ANALYSIS OF CLINICAL, RADIOLOGICAL AND FUNCTIONAL OUTCOME OF PROXIMAL FEMORAL NAILING IN UNSTABLE INTERTROCHANTERIC FRACTURES
Dissertation submitted for
M.S. DEGREE (BRANCH – II – ORTHOPAEDIC SURGERY)
THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY
All Sources
Match 1 of 4
Submitted to iGroup
Student papers - 3 papers
1%
Submitted to iGroup on 24-J... 1%
Submitted to iGroup on 21-F... <1%
Submitted to iGroup on 21-F... <1%
Thulasiraman, V.. "Locke...
Publication
1%
www.barnard.in
Internet source
<1%
cmch95.tripod.com
Internet source
<1%
bif.unom.ac.in
Internet source
<1%
educationjungal.com
Internet source
<1%
www.tamilnadunursingc...
Internet source
<1%
PAGE 1 OF 67
Text-Only Report
15:49
03-01-2014

turnitin

Your digital receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

Paper ID	385947529
Paper title	ANALYSIS OF CLINICAL, RADIOLOGICAL AND FUNCTIONAL OUTCOME OF PROXIMAL FEMORAL NAILING IN UNSTABLE INTERTROCHANTERIC FRACTURES
Assignment title	Medical
Author	22111511 . M.s. Orthopaedic Surgery SIVAKUMAR P . PONNUSAMY
E-mail	sivadoc2000@gmail.com
Submission time	02-Jan-2014 09:49PM
Total words	7344

First 100 words of your submission

ANALYSIS OF CLINICAL, RADIOLOGICAL AND FUNCTIONAL OUTCOME OF PROXIMAL FEMORAL NAILING IN UNSTABLE INTERTROCHANTERIC FRACTURES Dissertation submitted for M.S. DEGREE (BRANCH – II – ORTHOPAEDIC SURGERY) THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY CHENNAI, TAMILNADU APRIL – 2014 CERTIFICATE This is to certify that this dissertation titled "Analysis of clinical, radiological and functional outcome of proximal femoral nailing in unstable intertrochanteric fractures" is a bonafide record of work done by Dr.P.SIVAKUMAR, during the period of his Post graduate study from May 2011 to November 2013 under guidance and supervision in the Institute of Orthopaedics and Traumatology, Madras Medical College...

MASTER CHART

S.No	Name	Age	Sex	I.P.No	Side of Injury	Mode of Injury	Boyd & Griffin Type	Associate Injury	Time interval for surgery in days	Operating time in Minutes	Blood loss in ML	Method of reduction	Lag screw size in MM	Hip pin size in MM	Follow up in Month	Time for union in weeks	Harris hip score		Others
																	3 Month	6 Month	
1.	Doss	57	M	54362	Left	RTA	II	Nil	4	45	110	Closed	85	65	18	12	81	94	-
2.	Gnana prakasham	35	M	32871	Right	RTA	II	Nil	5	50	115	Closed	90	70	6	12	78	92	-
3.	Gunapriya	48	F	55621	Left	RTA	II	Nil	8	65	160	Closed	85	70	12	13	78	86	-
4.	Kadumbadi	80	F	78328	Right	RTA	II	Nil	11	90	320	Open	90	70	6	18	66	68	Wound Infection
5.	Mangammal	42	F	66739	Left	Fall	II	Nil	10	70	215	Closed	85	65	15	14	74	86	-
6.	Mubarak	33	M	97537	Left	RTA	II	Nil	5	45	120	Closed	85	70	5	12	78	92	-
7.	Premkumar	43	M	60342	Right	RTA	III	Fracture B/l condyle of mandible	12	65	160	Closed	90	75	14	14	76	84	-
8.	Rajan	65	M	86521	Right	Fall	II	Nil	10	65	165	Closed	85	65	10	13	72	82	Abductor Lurch
9.	Suresh	35	M	95623	Left	RTA	III	Nil	7	55	160	Closed	80	65	15	15	78	94	-
10.	Arunachalam	60	M	87812	Right	RTA	III	Fracture Radius	16	70	215	Closed	85	70	3	14	75	84	-
11.	Chandran	52	M	77621	Left	RTA	III	Nil	13	74	245	Closed	90	70	12	16	74	86	-
12.	Kala	45	F	76867	Right	RTA	II	Nil	8	50	120	Closed	95	80	14	14	78	94	-

13.	Venkatesan	48	M	86623	Right	RTA	II	Nil	8	70	160	Closed	90	70	12	14	75	86	-
14.	Murugesan	58	M	94561	Right	RTA	III	Nil	7	65	155	Closed	85	65	8	15	72	86	-
15.	Kuppan	68	M	55645	Right	Fall	IV	Nil	11	80	255	Open	85	70	9	18	68	76	-
16.	Rajamanickam	58	M	101251	Right	RTA	II	Nil	16	65	160	Closed	90	70	13	14	72	84	-
17.	Sivakami	57	F	86562	Left	RTA	II	Nil	15	70	160	Closed	85	65	10	13	71	84	-
18.	Thiruppati	59	M	96519	Right	RTA	II	Nil	9	85	220	Closed	85	70	8	16	74	82	-
19.	Veera muneswaran	77	M	102256	Left	Fall	IV	Nil	13	85	265	Open	85	65	6	18	68	74	-
20	Varatharajan	76	M	96121	Right	Fall	IV	Nil	18	90	260	Open	90	70	8	17	68	72	-
	Average	54.8							10.2	67.6	187				10	14.6	73.8	84.3	